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USSR REPORT

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ORGANIZATION, PLANNING AND COORDINATION

FROLOV ON DEVELOPMENT OF ENGINEERING

Moscow MOSCOW NEWS in English No 49, 1985 p 12

[Interview with Vice President of the USSR Academy of Sciences Academician Konstantin Frolov, director of the A.A. Blagonravov Institute for the Study of Machines, by MOSCOW NEWS correspondent Oleg Milyukov: "Engineering Rises to a New Stage"; date, place, and occasion not given; first paragraph is MOSCOW NEWS introduction; capitalized passages published in boldface]

[Text] The draft CPSU Programme points out that acceleration in the growth rate of Soviet engineering is the main direction in the long-term development and that it serves as a backbone for progress in science and technology in all branches of the national economy. How will this acceleration be achieved? This is the subject of the conversation which "MN" correspondent Oleg Milyukov had with Academician Konstantin FROLOV, Vice-President of the USSR Academy of Sciences, Director of the A.A. Blagonravov Institute for the Study of Machines.

[Question] What is the present-day scientific potential accumulated in mechanical engineering in this country?

[Answer] Everyone knows about the contribution which Soviet scientists have made to mathematics, mechanical engineering, physics, chemistry, and the theory of automatic control--areas of knowledge which will make up the engineering of the future. This country has mode undoubted progress in the peaceful exploration of space and in the branches of engineering producing machines for power engineering, metallurgy, transport, and other industries.

Over the past few years this country has created new automated coal-digging complexes and machine systems, installations for the continuous casting of steel, for metal casting-and-rolling machines, equipment for electroslag remelting and recasting of metal, machines for spindleless spinning and shuttleless weaving, machine tools for electro-physical and electro-chemical treatment of metals, unique welding equipment, automatic rotor transfer lines and machine-tool modules for flexible industries.

New technologies and equipment have been designed for most branches of engineering.

Nevertheless, we intend to make further sharp increases in the rate of progress in science and technology, to deepen fundamental research and to speed up the introduction of scientific developments in engineering practice.

The tasks facing us have been formulated very clearly. Between 1986 and 1990 we are to increase 1.5 to 2 times the growth rates in engineering. In the shortest time possible we are to start producing new generations of machines and equipment, which would allow us to increase productivity several times and to find a way for the application of advanced technologies.

[Question] What kind of scientific forces have been assigned to solve these problems?

[Answer] A very large force, starting with major institutes under the USSR Academy of Sciences, and ending with laboratories at individual industries.

Thousands of fundamental research projects with direct applications in engineering are under way at academic institutes such as the Institute of Solid State Physics, the Institute of Problems of Mechanics, the Institute of High Temperatures, the Institute of Metallurgy, the Institute for the Study of Machines, the Institute of Hydrodynamics and many more. Considerable contribution to progress in science and technology is being made by scientists at colleges and universities, and by branch scientific-research institutes and design bureaus.

[Question] How well coordinated is the research carried out at such different scientific establishments in terms of its applications in engineering?

[Answer] All these institutes are working as part of the purpose-oriented scientific and technological programmes in order to solve the most important scientific and technological problems. Every year, nearly 200 academic institutes take part in 112 programmes, fulfilling a total of approximately 3,000 specific tasks.

Great efficiency has been shown by the new Soviet scientific and industrial associations of which 240 have been set up, and more are to open. Success attends the operations at inter-departmental associations and engineering centres. In other words, we have sufficient scientific basis for a sharp acceleration in scientific progress. The results of this work are very tangible. Last year, 15 major inventions were registered in this country, nearly four thousand types of new machines, instruments and automatic equipment units were designed, over 11 thousand automatic and mechanized transfer lines were installed in industry, 10.5 thousand numerically controlled machine tools were produced, and 4.5 thousand new types of products were launched into production.

[Question] Since you intend to achieve a qualitatively new stage in development and sharp acceleration in scientific progress, the statistics you have just quoted must seem unsatisfactory to you.

[Answer] It is not the numbers we are after. This is a matter of major characteristics. It is possible to produce five thousand new materials, and

yet very few of them will really allow for provision of new and radical solutions. In other words, this is a matter of QUALITY, and not of the mere number of new machines, apparatuses and materials.

[Question] What ways do you see in this direction? Along what lines will the scientific and technological process continue in engineering?

[Answer] There are many ways, and they all can be grouped together into TWO MAIN HEADLINES. FIRSTLY, IT IS AUTOMATION, INCLUDING THE CREATION OF "UNMANNED" INDUSTRIES. SECONDLY, IT IS RAISING OF THE RELIABILITY AND EXTENDING THE SERVICE LIFE OF MACHINES.

[Question] But haven't scientists been doing this for years already?

[Answer] True enough. Today, however, we need a qualitative leap in both automation and in extending machines' useful life.

Let us begin with automation, which is a new problem indeed. In the lifetime of one human generation, several generations of machines have been replaced. Today, "unmanned" industries are to be designed. It would be wrong, however, to apply this "overworked" term to industry. There are practically no production units which would dispense with the human presence. It is nevertheless realistic to make sharp reductions in the number of workers on the shop floor. The whole world is working in this direction. We in the Soviet Union are working on machine-tool modules for automated flexible industries, as well as robots and controlling machines. From my point of view this process is somewhat disorganized. At present, the Academy of Sciences is evolving the concept of flexible industries. This situation, where practice finds itself too far ahead of theory, is being corrected. Fundamental development of the theory of automated industries will allow us to establish the most expedient areas in the use of these systems, their compositions, functions, etc. This will allow us to optimize production and the level of automation.

I would like to note that a succession of stages in major engineering industries is a complex and long process. The most advanced equipment so greatly spoken about makes up only an insignificant part of all machinery, and is peacefully coexisting with conventional machines. This is true not only of this country. Statistics places the number of numerically controlled machines used in engineering in the United States in 1983 at only 5.5 per cent of all the machines, with only two programmable robots to one thousand industrial workers.

[Question] What problems will be solved in automation?

[Answer] As I have just said, it is necessary to evolve a theory of these machines and equipment and to design new machines in keeping with this theory. You should not have an impression that this work has just begun. What we know now is enough for us to see what is wanted for the best possible level of automation in industry.

In the near future the traditional metalworking equipment is to go through substantial changes. It should be modified so that it could operate in tandem with automatic transport systems, industrial robots, and plate-measuring engines. Numerically controlled machines based on microprocessors and microcomputers should be introduced on a large scale. Machines are being designed so as to take into account the changing operating conditions.

The main task now is to "teach" machines to operate without man's presence. They should be able to position the workpieces whose types and sizes can change from hour to hour. They should also be able to select the mode of machining and themselves to control the quality of their own operations.

This certainly requires new technologies. The machine modules which have only begun to be made on a large scale are well suited for "unmanned" industries. Intense work is being carried out on new robots. What we need is not merely manipulators which can take up a workpiece and pass it on, but robots which can identify objects, their position in space, etc.

We also need machines that would trace the entire process of machining. Some have been designed and are manufactured. They are plate-measuring engines of different types which can automate the process of positioning of the workpiece in the machine, give commands at various stages in machining, and check the precision of manufacture.

[Question] You have mentioned as the second line in scientific and technical progress efforts towards greater reliability and service life of machines. What is needed for a qualitative improvement in this direction?

[Answer] Completion of the fundamental research now under way at many institutes and its industrial application.

At present, the main defect in any machine is the different service life of its parts. The first to break down are parts with friction, the most numerous in any machine. Until quite recently scientists differed in their explanations of why parts subject to friction break. For example, they failed to see any links between the breakage and the loss of metal strength due to metal fatigue.

At present scientists at the A.A. Blagonravov Institute for the Study of Machines at the USSR Academy of Sciences are engaged in research into friction and wear-and-tear resistance. In our view, the results of their comprehensive research will extend the useful life of units with friction by thirty to fifty per cent as compared with what we have now. This is an average, and in some cases the increase will be even higher.

[Question] What specific ways do scientists foresee in the achievement of much longer service life for machines?

[Answer] Large reserves in this direction can be found in the process of designing. The traditional approach takes into account only some, and not all the requirements imposed on the new machine. At present, advanced methods

have been evolved for designing machines proceeding from a number of criteria. Every one of these can only be taken into account by a computer. Automatic design systems allow for an optimizing of the solutions in design and technology when new machines are still at a blueprint stage.

A promising reserve in increasing the life of parts is strengthening treatment. It would seem that the technology for making machine parts more robust has been known for a long time, yet in recent years new highly efficient methods have been found. First and foremost of them is the vacuum plasma methods for coating components with hard-alloy compounds such as nitrides and carbides of titanium, tungsten and boron. A thin layer of hard coating increases the wear-and-tear resistance several times. This method also comes in handy in the application of antifriction layers.

This technology is naturally applicable not only in machining of assemblies subject to friction. Methods have been designed for reinforcing machine parts most vulnerable to wear and tear, such as in grain harvesters, to make them last several times longer.

A favourable effect on the surface of parts is irradiation with power laser beams. Laser treatment makes the friction coefficient much lower and raises resistance to both wear and tear, and to scoring. Besides, laser beam creates compression tensions in the surface layers, hardening the metal and making it last longer.

[Question] Reinforcement is made for use on traditional metals. Yet special materials were compounded long ago, especially for assemblies with friction. Take fluoroplastics, which have greatly reduced friction and lengthened the service life of friction pairs, which makes them useful much longer. Or take materials based on the disulphide of molybdenum, which can allow us to dispense with lubricants in highly heavy-duty assemblies in most complex conditions. What are the prospects for the use of these materials? Are any similar new materials being looked for?

[Answer] Fluoric plastics in combination with metals have become a widely used material in sliding bearings in aircraft construction, motor industry, textile engineering, and in other areas. Every year this country produces nearly ten million metal fluoric bearings.

However, still more efficient antifriction materials are needed in various technologies. Scientists at the A.A. Blagonravov Institute and in other places are working on such materials. Scientists at out Institute have designed materials like S-1 and S-1-U. Bearings made of these materials last 25 times as long as the conventional ones. This figure is no mere speculation. It has been proved in conditions of protracted operation. Bearings of the new materials have been used in the pumps of the nuclear-powered icebreaker Lenin, and in condensate pumps at heat- and electricity-generating plants. At present the new materials have begun to be used in bearings of high-speed grinding machines.

Another new material for machine friction units lubricates itself. Called AMAN, it is based on polyacrylate resins with a high molybdenum disulphide

content. In a number of cases it has proved better than the hard lubricants based on fluoroplastics.

Perfect characteristics have been found in materials based on molybdenum coated with a thick layer of selenium in friction assemblies exposed to temperatures of up to 900°C.

Non-conventional methods can be used to advantage in the radical solution of the most complex problems. Because they operate in heavy-duty conditions, supports of boring heads in machine tools have a very short life. Newly designed gas supports have made it possible to extend the life of these heads several times. Machine tools with these units have been installed at the VAZ Motorworks. The life of these parts is ten to fifteen times longer than in similar American boring heads.

As you see there are considerable possibilities for increasing the durability of engineering components.

A considerable improvement can be achieved by perfecting the structure of metal which is the main structural material in engineering. The theoretically possible durability limit of metals is one hundred times higher than the real one. Modern metals have an imperfect structure. The source of this imperfection is already present in the bar of metal before it is worked. However, the scientists have found a way for changing the structure by means of ultrasonic processing of the metal bars in the process of crystallization. This reduces the size of micro- and macro-grains, and improves the homogeneity of various additions all through the volume of the bar. This also makes the inner structure more stable. As a result, the mechanical characteristics of metals, their durability and plasticity improve.

[Question] In an inexhaustible conversation about progress in science and technology, we have only touched on some matters. There is much we have left out. What, in your view, are the most salient points that we have not discussed?

[Answer] Progress in science and technology and the intensification of the economy are not an aim in itself. The main task of these efforts is to solve social problems. These consist, first and foremost, in raising the living standards of the Soviet people to a qualitatively new level. Over the next fifteen years it is envisaged to double the amount of resources spent to meet the needs of the people. The line will be consistently implemented to achieve a drastic reduction in purely manual jobs, and a substantial decrease will be made in the amount of monotonous, unskilled and hard physical work which is to be eliminated in the future. Intensification and growing productivity will open up novel opportunities for introducing shorter working hours and longer paid leaves. In short, the working conditions and the quality of life should be consistently and steadily improved.

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ORGANIZATION, PLANNING AND COORDINATION

SOCIOECONOMIC DEVELOPMENT LINKED TO ACCELERATION OF S&T PROGRESS

Kiev EKONOMIKA SOVETSKOY UKRAINY in Russian No 9, Sep 85 pp 71-76

[Article by candidate of economic sciences N. Yermoshenko under the rubric "For Propagandists and Students of the System of Economic Training": "The Improvement of the Planning and Management of Scientific and Technical Progress"]

[Text] Scientific and technical progress has turned into a decisive factor of the increase of the efficiency of social production and has begun to determine the rate of development of the economy in the process of the formation of mature socialism. The intensification of the national economy is now also impossible without it. "As the main strategic lever of the intensification of the national economy and the better use of the gained potential," M.S. Gorbachev emphasized at the April (1985) CPSU Central Committee Plenum, "the party is bringing to the forefront the cardinal acceleration of scientific and technical progress." Such a role of scientific and technical progress is constantly being taken into account in the activity of the CPSU and the government on the improvement of the mechanism of the management of scientific and technical progress as an important component of the economic mechanism of mature socialism. The work of the conference on questions of scientific and technical progress, which was held in the CPSU Central Committee on 11-12 June 1985, and the July (1985) Ukrainian CP Central Committee Plenum was aimed at this.

The implementation of the concept of the acceleration of the economic and social development of the country, which was formulated at the April (1985) CPSU Central Committee Plenum, requires the substantial increase of the pace and return of scientific and technical progress in the national economy and in all its units. Scientific and technical progress becomes an object of management only under the conditions of the socialist mode of production. This stems from the existence of the public ownership of the means of production, the effect of the system of economic laws of socialism, the planned, proportionate development of the national economy, and the possibility of the fundamental combination of the achievements of the scientific and technical revolution with the advantages of the socialist system of management. The sectorial system is the basic system in our country of the management of scientific and technical progress owing to the centralized nature of socialist management. A large number of advantages,

among the basic ones of which there are: the opportunity to specify and implement on the scale of the entire state a unified scientific and technical policy; to ensure the orientation of scientific and technical progress toward the solution of the most important economic and social problems of the development of Soviet society; to concentrate and to use efficiently financial and material resources; to properly take into account and use the world scientific, technical, and organizational level of production, are inherent in it.

However, as V.V. Shcherbitskiy emphasized at the July (1985) Ukrainian CP Central Committee Plenum, "it is necessary to proceed from the fact that new production economic problems, which scientific and technical progress is posing for us, will constantly arise. We should learn to solve them competently and in good time." At the April (1985) CPSU Central Committee Plenum and at the conference in the CPSU Central Committee on questions of the acceleration of scientific and technical progress as a result of a thorough analysis the causes of certain difficulties in the economic development of the country, which arose in the early 1970's, were identified. The main cause of such a situation was also named with the adherence to principle, which is characteristic of the party: the radical change of the economic situation was not properly taken into account and the necessary persistence was not displayed in the reform of structural policy, the forms and methods of management, and the very psychology of economic activity. The shift of the center of gravity to the use of intensive factors of economic development was spoken about for many years, but the taken steps were half-hearted and inconsistent and, moreover, were not completely implemented.

The implementation of the concept of the acceleration of the socioeconomic development of the country is causing the need for new qualitative growth of the national economy, the changeover to the intensive path of development, the structural reform of the economy, the use of effective forms of the management, organization, and stimulation of labor, and the more complete solution of social problems. All these problems are connected in one way or another with the accomplishment of scientific and technical progress.

The basic objective prerequisites of the need for the improvement of the planned management of the development of science and technology are the following. First, there are the qualitative features of the acceleration of scientific and technical progress under the conditions of the improvement of mature socialism. Among them are: the substantial increase of the scale of scientific research and the introduction of scientific and technical achievements in the national economy (the amounts of introduction of scientific and technical achievements in USSR industry have increased with respect to the basic indicators during the current five-year plan as compared with 1966-1970 by 1.8- to 25-fold); the transformation of scientific and technical progress into a decisive factor of the increase of the efficiency of social production; the need for the conformity of the scale and efficiency of scientific and technical progress to the dynamics and scale of the development of the economy of mature socialism; the comprehensive nature of scientific and technical progress; the subordination to a greater and greater degree of the acceleration of scientific and technical progress to the solution of the most important social problems of society.

Second, the sectorial system of the management of scientific and technical progress, although ensuring the increase of the absolute amounts of the introduction of scientific and technical innovations in the national economy, in many cases does not have the necessary influence on the acceleration of scientific and technical progress. The slowing for the country as a whole of the growth rate of the basic indicators of scientific and technical progress during the 10th and especially the 11th five-year plans as compared with the 9th Five-Year Plan is evidence of this: of the 12 analyzed basic indicators of scientific and technical progress for 7 the growth rate decreased to one thirty-fifth to one-half, for 4 has negative values, that is, instead of an increase a decrease of their absolute values was allowed, and only for 1 is there a small increase. The picture for the Ukrainian SSR is somewhat better: for these seven indicators the growth rate was one-thirteenth to one-third as great, for four it is negative, for one there was no increase. The average annual growth rate of the majority of indicators is less than the growth rate of the production volumes. This testifies that the size of the scientific and technical reserve is decreasing. Meanwhile, the need for the acceleration of the socioeconomic development of the country requires not the decrease, but the substantial increase of the rate of the implementation of scientific and technical progress, first of all, in industry and its sectors which determine the acceleration of scientific and technical progress.

Third, the development of specialization and cooperation in science is giving rise to a large number of complex, primarily intersectorial problems of an organizational and economic nature, which are connected with the appearance of a significant number of intermediate, vertical and horizontal, units in the science-production cycle "science--technology--production--consumption" and with the need for their joining. The lack of conformity of the territorial sectorial nature of the management of academic science to the sectorial nature of the management of applied research and development leads in many cases to the slowing of the conversion of basic research as a generator of ideas into applied research and, at times, also to the long-term break of these units. As is known, the increase of the return from the scientific and technical potential to a significant degree is determined by the availability and state of its pilot experimental and planning and design base. However, its organizational and technical level is low and far from always meets the needs of the introduction of scientific and technical developments.

Fourth, annually the introduction of scientific and technical measures provides only 3 percent of the increase of labor productivity and 2 percent of the saving of fuel and raw materials with the simultaneous decrease of the output-capital ratio on the average by 3 percent, which in many ways depreciates the achieved results. (Footnote 1) (PRAVDA, 13 July 1985) At present the expenditures on the conditional release of one worker due to the implementation of scientific and technical measures have increased as compared with 1970 by 1.5-fold and have reached 22,900 rubles. The amount of increase of the profit per ruble of expenditures for the implementation of scientific and technical measures during this period decreased. In republic industry during the 11th Five-Year Plan the increase of labor productivity due to the implementation of scientific and technical measures is not increasing and comes to 2.2 percent a year.

The indicated prerequisites owing to the law of the conformity of the mechanism of the management of scientific and technical progress to the level and nature of the development of science and technology require a new quality in the management of scientific and technical progress. Here it is important to ensure a systems approach to the improvement of the mechanism of the management of scientific and technical progress and to encompass all its components by rationalization: laws, goals, principles, functions, methods, organizational structure, equipment, technology, and personnel, the tools of influence on the acceleration of scientific and technical progress (programs and plans), the criteria of the evaluation of the efficiency of the management of the development of science and technology. It is also necessary to learn to use more effectively in the management of scientific and technical progress the set of economic laws of socialism as the objective basis of all their converted forms which are included in the structure of the mechanism of the management of scientific and technical progress.

Means of improving the planning and management of the development of science and technology were specified at the conference in the CPSU Central Committee on questions of the acceleration of scientific and technical progress. Among the basic ones of them are: the further increase of the planned elements in the development of science and technology; the increase of the role of goal program management in the development and introduction of scientific and technical achievements; the more extensive use of economic levers and stimuli for the purpose of the substantial increase of the economic and social efficiency of scientific and technical progress and its influence on the end results of the work of all the units of the national economy. As applied to the national economy of the Ukraine these directions were examined in detail at the July (1985) Ukrainian CP Central Committee Plenum, at which measures on the accomplishment in the republic of the tasks, which were posed at the conference in the CPSU Central Committee on questions of the acceleration of scientific and technical progress, were approved.

Significant space is devoted to the improvement of the planning and management of scientific and technical progress in the decree of the CPSU Central Committee and the USSR Council of Ministers "On the Extensive Dissemination of New Methods of Management and the Increase of Their Influence on the Acceleration of Scientific and Technical Progress." The need for the assurance of the further improvement of the new methods of management and, first of all, in the direction of the increase of the influence of the economic mechanism on the acceleration of scientific and technical progress, the increase of product quality, and the creation of a genuine interest in this of labor collectives and all the units of the national economy is emphasized in it. Important measures on the improvement of the planning of scientific and technical progress, on the increase of the quality of products on the basis of the better use of their certification and of the role of the production development fund and material and technical supply in the retooling and renovation of production, and on the development of deliveries of complete sets of machine building products and the material stimulation of work on the acceleration of scientific and technical progress are outlined in the decree.

A proposal, in conformity with which the plan of the development of science and technology should become the load-carrying component of the entire

national economic plan, was made at the conference in the CPSU Central Committee. The quality indicators, which reflect the efficiency of the use of resources, the scale of the updating of products, and the increase of labor productivity on the basis of the achievements of science and technology, should hold a leading place in the plans. This requirement should be applied to the plans of economic and social development of all levels: the country, sectors, the national economy, the union republics, regions (autonomous republics, krays, oblasts, cities, and rayons), associations, and enterprises.

Scientific and technical progress as an object of both sectorial and territorial planning is the continuous process of the development and improvement of equipment and technology and the organization of production, labor, and management. Two structural breakdowns: by directions of scientific and technical progress and by stages of the science-production cycle, characterize it. Scientific and technical progress includes the following basic directions which are common to all the sectors of the national economy: the development and assimilation of new products and the increase of the quality of the products being produced (services); the introduction of advanced technology, the retooling and renovation of production (service); the mechanization and automation of production (service); the scientific organization of labor; the improvement of the management, planning, and organization of production (service).

The unconditional observance of the basic requirements, which have been formulated by economic science and management practice, is one of the directions of the improvement of the planning of the development of science and technology. The main one of them is comprehensiveness, which signifies, first, the encompassing by planning of all the directions of scientific and technical progress, all the stages of the science-production cycle "science--technology--production--consumption," all the sectors of the national economy, and all its units. Second, the assurance of the conformity of the set of directions and indicators of the plans of the development of science and technology and the indicators of statistical reporting at all levels of the management of the economy. The realization of this requirement will make it possible to organize the truly continuous planning of the development of science and technology both vertically (with a breakdown by sectors) and horizontally (with a breakdown by territories) and, moreover, in conformity with the existing statistical reporting on scientific and technical progress.

The requirement of the continuity of the planning of the development of science and technology is based on the continuous nature of scientific and technical progress itself and the principle "that the improvement of the economic mechanism is a continuous process." (Footnote 2) (M.S. Gorbachev, "Aktivno deystvovat, ne teryat vremeni" [Work Actively, Do Not Waste Time], Moscow, Politizdat, 1985, p 45) It should be implemented in the mandatory coordination of the current plans with the five-year plans and of the latter with the Comprehensive Program of Scientific and Technical Progress for a 20-Year Period. This applies to the union, sectorial, republic, and regional levels.

The combination of the sectorial and territorial planning of the development of science and technology is based on the principle of democratic centralism. For the assurance of the realization of this requirement a chain of the planning of scientific and technical progress of the following type: from the section "The Development of Science and Technology" of the state plan of USSR economic and social development to the union republic and the union and union-republic ministries and departments and further through the regions to production associations and enterprises, should be observed in the practice of planning. The assurance of the combination of both aspects in the planning of scientific and technical progress will make it possible to carry out the comprehensive economic and social development of both sectors and regions.

The realization of this requirement causes the need for the use of iterativeness, that is, the necessity of the successive coordination in the plans of the development of science and technology at all levels of sectorial and territorial interests in the accomplishment of scientific and technical progress, as well as their possibilities.

The requirement of the reflection of the results of scientific and technical progress in the plans of the economic and social development of all the units of the national economy is based on the role of the scientific and technical revolution in the development of the economy and the solution of social problems. The most advisable means of realizing this requirement is the use of standards of the influence of the results of scientific and technical progress in the plans of economic and social development. This will make it possible to place all the units of the economy under such conditions, when without the implementation of the planned scientific and technical measures to the full extent and on the set date the basic indicators of the plan of economic and social development (the volumes of the production and sale of products in conformity with contracts, productivity, the profit, the production cost) will not be fulfilled.

The further improvement of the set of indicators and standards of scientific and technical progress is the next direction of the improvement of the planning of the development of science and technology. The indicators of the acceleration of scientific and technical progress should in practice become an integral part, the basis of all the sections of the plan of the economic and social development of any unit of the national economy. For this it is advisable to include the assignment on new equipment in the plan of the production of output in physical terms, and to include the cost of the work on the assimilation in production of new equipment in the plan of the sale of products with allowance made for contractual obligations. (Footnote 3) (PRAVDA, 4 August 1985) The implementation of these measures will make it possible to equalize in rights the new product and the product being produced and thereby to discipline and increase the responsibility of associations and enterprises for the assimilation and production of new equipment. Economic standards which are intended for a 5-year period: the influence of the results of scientific and technical progress on the basic indicators of the plan of economic and social development, the financing and extension of credit for new equipment, the economic and material stimulation of the implementation of scientific and technical measures, and others, have to be used more

extensively in the planning of the development of science and technology. This will make it possible to decrease the number of planned indicators of scientific and technical progress, to free associations and enterprises from petty guardianship on the part of superior organs, and to increase the independence of the primary units of the national economy in the solution of the problems of accomplishing scientific and technical progress.

The existence along with sectorial planning of territorial planning is another direction of the improvement of the planning of the development of science and technology. At present local organs are deprived of the opportunity to influence the accomplishment of scientific and technical progress on their territories and by means of this to actually ensure on them comprehensive economic and social development. The provision of local organizations with the rights of participation in the drafting and implementation of the plans of the development of science and technology and the corresponding responsibility will make it possible to increase the influence on the acceleration of scientific and technical progress. It is possible to accomplish this by the inclusion in the plans of the economic and social development of regions of a section on the development of science and technology, and by the assignment to the local soviets of people's deputies of the right of the receipt from the ministry and departments of drafts of the plans of the development of science and technology with respect to their own enterprises and their corresponding adjustment in case of the need for the assurance of more comprehensive economic and social development on the attached territories in consultation with superior sectorial organs. The departments of scientific and technical progress (labor and scientific and technical progress, manpower resources and scientific and technical progress), which have been created in all the oblast planning commissions of the Ukraine, should act as the subject of the territorial planning of the development of science and technology.

Definite experience has already been gained in this direction in the republic. Plans of scientific and technical progress as components of the plans of the economic and social development of these regions were drafted and implemented during the 10th Five-Year Plan in Donetsk and Kharkov Oblasts and during the 11th Five-Year Plan in Voroshilovgrad, Donetsk, Rovno, and Kharkov Oblasts. The results of the implementation of the indicated plans of scientific and technical progress convincingly confirm the possibility, necessity, and efficiency of the territorial planning of the development of science and technology for a 5-year period.

The plan of the development of science and technology in the oblast should be included structurally, on the one hand, in the plan of the economic and social development of the given region and, on the other, in the section "The Development of Science and Technology" of the state plan of the economic and social development of the union republic.

The need for the extensive use of the goal program approach to the management of scientific and technical progress is dictated, on the one hand, by the needs of the further improvement of the management of scientific and technical progress, on the other hand, by the great material and technical, financial, and economic organizational possibilities of the economy of mature socialism for its more complete implementation, and, third, by the ever increasing

number of intersectorial scientific and technical problems, which it is more and more difficult to solve by means of the plan. "The implementation of the goal program approach will contribute," V.V. Shcherbitskiy indicates, "to the strengthening of the unified scientific and technical policy, the more complete use of the advantages of the socialist system of management, and the further increase of the efficiency of social production." (Footnote 4) (V.V. Shcherbitskiy, "Nauchno-tekhnicheskiy progress--zabota partiynaya" [Scientific and Technical Progress Is a Party Concern], Kiev, Politizdat Ukrainy, 1983, p 267)

It is possible to reveal the essence of the goal program management of scientific and technical progress in its basic components: problem--goal--program--organizational structure of management. These components constitute the basis of the technological chain of goal program management, which presumes the existence of at least the following stages: 1. The choice of the problem (problems), which is liable to program solution. 2. The determination of the goal (tree of goals) of the program. 3. The formulation of the program. 4. The inclusion of the assignments of the program in the plan. 5. The determination and formation of the structure of the management of the program. 6. The implementation of the program. 7. The evaluation of the results of the implementation of the program. The implementation of the system of the goal program management of scientific and technical progress made it possible to carry out in combination the solution of important scientific and technical problems.

The goal program approach to the management of scientific and technical progress has received in the country and the republic practically universal dissemination. During the 11th Five-Year Plan more than 340 programs of the republic, sectorial (intersectorial), and regional (oblast and interoblast) levels are being implemented in the Ukrainian SSR. Just by the implementation of republic programs since the beginning of the five-year plan in the national economy of the republic a saving of the labor of more than 2.5 million workers has been obtained, the consumption of metal as compared with the end of the 10th Five-Year Plan has decreased by more than 1 million tons and cement--by 200,000 tons, more than 9 billion kilowatt-hours of electric power have been saved. The greatest impact from the use of the goal program approach has been obtained in the change of the material intensiveness of the national product: whereas during the 10th Five-Year Plan it increased annually, in 4 years of the current five-year plan it has decreased by 2.2 percent.

Nevertheless the goal program approach to the management of scientific and technical progress requires further development. These problems were discussed comprehensively at the meeting of the Council for the Promotion of Scientific and Technical Progress attached to the Ukrainian CP Central Committee in September 1984, at which it was decided during the 12th Five-Year Plan to change over from uncoordinated programs of different levels to the formation of an interconnected set of them, which ensures the implementation of a unified scientific and technical policy in all the units of the economy. This set includes scientific and technical goal programs which are formulated at the republic, sectorial, and regional levels. A basic feature of such a set consists in the interconnection "vertically" of programs of the same type, that is, all the sectorial and regional programs should include the

assignments of the all-union and republic programs which are being implemented at the enterprises of the sector or region. The formation of the set of programs in the Ukrainian SSR for the 12th Five-Year Plan is being carried out on the basis of the approved corresponding procedural instructions. Procedural materials have also been prepared for the formulation and the management of the implementation of regional programs.

V.V. Shcherbitskiy emphasized that "the success of our work during the next five-year plan in many ways will be governed by how we formulate and, what is the main thing, how we implement the republic scientific and technical programs ('The Energy Complex,' 'Metal,' 'The Material Intensiveness,' 'Labor,' 'The Agroindustrial Complex,' 'Transportation'), the Biotechnology Scientific Program, as well as the corresponding sectorial and regional programs. The unity of the goals of the programs of all levels and their close interconnection vertically and horizontally should be ensured." (Footnote 5) (PRAVDA UKRAINY, 17 July 1985) For this the basic assignments of the republic scientific and technical programs should be transformed with a breakdown by sectors and regions and be included in a specified form in the corresponding sectorial and regional scientific and technical programs. However, this by no means implies that all six of the indicated programs of the same type should be formulated in each sector and in each oblast. The assignments of the latter can also be taken into account in other programs which are aimed at the solution of purely sectorial or regional scientific and technical problems. With allowance made for the gained experience and the real possibilities of the simultaneous implementation of several programs in sectors and oblasts it is recommended to formulate not more than five to seven of them. Here the formulation of regional programs like "Labor" and "The Agroindustrial Complex" is mandatory for each oblast.

The requirement of the unity of the main goals and the interconnection of the basic assignments of programs of the same type is supplemented fundamentally by the requirement of the coordination of their efficiency. The indicators of the efficiency of republic programs will be reported to all ministries and departments and the oblasts. This will make it possible to determine more accurately the contribution of each sector or oblast to the accomplishment of the main goal of one republic program or another. Such an approach to the formation of the set of scientific and technical programs will make it possible to ensure the more complete combination of the sectorial and regional aspects in the goal program management of the development of science and technology. The observance of the requirement of the anticipatory taking of steps on not allowing a lag of the fulfillment of the assignments behind the planned deadlines or volumes holds an important place in the implementation of the outlined goal programs of all levels.

During the 12th Five-Year Plan the system of supervision, which for the most part justified itself earlier and in case of which a comparatively small number of programs corresponded to each level of management, has been retained for the management of the programs. Such an approach makes it possible to place personal responsibility for each of the programs on people who have been given the corresponding power. At the level of the republic these are the deputy chairmen of the Ukrainian SSR Council of Ministers, the sectors--the

deputy ministers, the oblasts--the secretaries of the oblast party committees and the deputy chairmen of the oblast soviet executive committees.

For the purpose of improving the monitoring of the implementation of the programs of all levels duplication has to be eliminated in the area of the checking of the fulfillment of the union republic programs on the part of the Ukrainian SSR Central Statistical Administration and the territorial scientific and technical information centers. The information on the implementation of the assignments and stages of these programs is gathered simultaneously. It is also necessary to settle the question of carrying out the monitoring of the implementation of regional scientific and technical programs. The experience available in the republic of their checking on the part of a number of scientific and technical information centers (the Kiev Department of the Ukrainian Scientific Research Institute of Scientific and Technical Information, the Voroshilovgrad and Odessa Centers) under the supervision of the councils for the promotion of scientific and technical progress attached to the oblast party committees suggests that it is advisable to assign this work to the scientific and technical information centers. The subdivisions for scientific and technical progress within the oblast planning commissions should also not remain aloof.

The Comprehensive Program of Scientific and Technical Progress for the Ukrainian SSR for a 20-Year Period and the regional comprehensive programs of scientific and technical progress (the sections "Regional Problems of Scientific and Technical Progress" for the corresponding regions) hold a special place in the system of the improvement of the planning and management of scientific and technical progress. The formulation of such programs is the first phase of the planning of the development of science and technology, in conformity with which the section "The Development of Science and Technology" in the plans of economic and social development and scientific and technical goal programs should subsequently be formulated at all levels.

The spectrum of the economic and social results of scientific and technical progress is broad and diverse. The development of science and technology has an effect on practically all aspects of the development of the economy and socialist society. According to estimates, in the past 25 years 77 percent of the increase of the national income was provided by means of scientific and technical progress, in industry of the country during the current five-year plan it is providing more than 90 percent of the increase of labor productivity, three-fourths of the increase of the output of products, more than half of the decrease of the production cost, and approximately 60 percent of the saving of fuel and energy resources. But these are relative indicators. Given a significant increase of the amounts of the introduction of scientific and technical achievements the results of scientific and technical progress and, as a consequence, the absolute values of the growth rate of the basic indicators of the economic and social development of the country and all the units of its economy will increase accordingly. Meanwhile, at present 80 percent of the new developments are being introduced at only 1 enterprise, less than 20 percent--at 2 or 3 and only 0.6 percent--at 5 and more. (Footnote 6) (B.Ye. Paton, "Scientific and Technical Progress: The Current Trends and Prospects," KOMMUNIST UKRAINY, No 10, 1984, p 61)

Given the increase of the range and extents of the use of scientific and technical innovations one should bear in mind one essential feature: 80 percent of the total impact of scientific and technical achievements is contained in just one-fifth of them. (Footnote 7) (V.G. Lebedev, "The Increasing Role of Scientific and Technical Progress in the Implementation of the Economic Strategy of the CPSU," in the book "Nauchno-tekhnicheskiy progress: zakonomernost, sotsialno-ekonomicheskaya effektivnost" [Scientific and Technical Progress: The Governing Laws, the Socioeconomic Efficiency], Moscow, AON pri TsK KPSS, 1983, p 22). This is, as a rule, new technologies which pay for themselves on the average in a year. A small number of operations, a sharp decrease of the material and labor intensiveness, a low-waste and waste-free nature, and the possibility of automating the control of technological processes by the use of computers are characteristic traits of such technologies. At the July (1985) Ukrainian CP Central Committee Plenum the task was posed to speed up substantially the assimilation of fundamentally new technological processes and first of all waste-free and low-waste processes.

In the decisions of the plenum it is outlined to increase significantly during the 12th Five-Year Plan the return of scientific and technical progress in the basic directions: to increase the rate of decrease of the expenditures of manual labor by two- to threefold and by means of this to free not less than 1.5-2 million people; to speed up by two- to threefold the rate of the taking out of operation of obsolete fixed capital and its replacement with highly productive modern equipment; to increase by 1.5-fold the annual economic impact by the use of the achievements of science and to increase it to 4.5-5 billion rubles, and from the introduction of developments of inventors and efficiency experts to obtain annually a saving of 1.8-2 billion rubles.

In order to accelerate scientific and technical progress substantially and to secure its contribution to the development of the economy, which ensures the greatest labor productivity and efficiency of the national economy, it is necessary, in the words of M.S. Gorbachev, to make the economy dynamic, balanced, and most receptive to scientific and technical progress and to ensure the vital interest in this of all the units of the national economy and their strict responsibility for the introduction of the latest achievements of science and technology and for the achievement of the leading levels in the world. At the conference in the CPSU Central Committee on questions of the acceleration of scientific and technical progress for the accomplishment of this task it was planned to use actively more flexible forms and methods of management, cost accounting, and commodity-money relations.

Measures on the strengthening of the economic nature of the management of scientific and technical progress are also being outlined and implemented in the fraternal socialist countries.

The strengthening of the economic nature of the management of scientific and technical progress will be accomplished by the increase of the influence of the consumer on the technical level and quality of products; the radical improvement of pricing; the changeover in practice of associations and enterprises to complete cost accounting; the establishment of a close connection between the results of the work of the collective on the

acceleration of scientific and technical progress and the system of the remuneration and material stimulation of labor; the creation of new organizational and economic conditions for the practicable use of economic stimulation funds and first of all the production development fund.

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ACTIVITY OF LITHUANIAN SSR ACADEMY OF SCIENCES IN 1984

Vilnius TRUDY AKADEMII NAUK LITOVSKOY SSR, SERIYA B in Russian No 5, Sep-Oct 85 pp 101-120

[Article by Y. Samytis, Ya. Ignatyeva, N. Kharitonova, V. Petrauskas: "The ectivities of the Lithuanian SSR Academy of Sciences in 1984"]

[Text] Structure. In the system of the Order of Friendship of Peoples Lithuanian SSR Academy of Sciences (AN) in 1984 there were 3 departments of sciences, which united 12 institutes:

--the Physical, Technical, and Mathematical Sciences Department--the Institute of Mathematics and Cybernetics (IMK), the Institute of Physics (IF), the Order of Labor Red Banner Institute of Semiconductor Physics (IFP), the Institute of Physical and Technical Problems of Energetics (IFTPE),

--the Chemical, Technological, and Biological Sciences Department--the Order of Labor Red Banner Institute of Chemistry and Chemical Technology (IKhKhT), the Institute of Biochemistry (IBkh), the Institute of Botany (IB), the Institute of Zoology and Parasitology (IZP) (with the Department of Geography (OG)),

--the Social Sciences Department--the Institute of Economics (IE), the Institute of Philosophy, Sociology, and Law (IFSP) (with the Center of Scientific Information on the Social Sciences (TsNION)), the Institute of History (II), the Institute of Lithuanian Language and Literature (ILYaL).

On 31 December 1984 there were 161 subdivisions (laboratories, departments, bases, experimental sections, workshops) at the institutes of the Academy of Sciences.

In 1984 five new subdivisions of institutes were established: the Department of Systems Programming (the Institute of Mathematics and Cybernetics), the Laboratory of the Control of Calculations (the Institute of Mathematics and Cybernetics), the Experimental Plant of Assemblies of Computerized Instruments and Software (the Institute of Mathematics and Cybernetics), the Laboratory of Nonequilibrium Processes (the Institute of Semiconductor Physics), the Laboratory of the Identification of Systems (the Institute of Physical and Technical Problems of Energetics).

The Laboratory of Computer Control Devices (the Institute of Physical and Technical Problems of Energetics) was dissolved, the Laboratory of the Introduction and Acclimatization of Plants and the Laboratory of Medicinal Plants were united into the Laboratory of Introduction and Landscaping (the Institute of Botany). The Laboratory of Species Biology and the Laboratory of Ichthyology and Hydrobiology were united into the Laboratory of Ichthyology (the Institute of Zoology and Parasitology).

The Laboratory of the Genetics of Microorganisms and the Mutagenesis of Plants was renamed the Laboratory of Genetics (the Institute of Botany), the Laboratory of Carcinology was renamed the Laboratory of Hydrobiology (the Institute of Zoology and Parasitology), the Department of the Economic Efficiency of Scientific and Technical Progress was renamed the Department of the Comprehensive Program of Scientific and Technical Progress (the Institute of Economics), the Laboratory of the Software of Economic Research was renamed the Department of the Automation of Economic Calculations (the Institute of Economics), the Department of Sociological Problems of Management was renamed the Department of Problems of the Socialist Way of Life (the Institute of Philosophy, Sociology, and Law).

In the system of the Academy of Sciences (attached to the Academy of Sciences or the Presidium of the Academy of Sciences) there were:

--six institutions--the Central Library of the Academy of Sciences (TsB), the Foreign Languages and Philosophy Chairs, the Editorial Office of the journal TRUDY AKADEMII NAUK LITOVSKOY SSR, (Footnote 1) (1984 was the 30th year of the publication of the journal TRUDY AKADEMII NAUK LITOVSKOY SSR. See more extensively on the publication of the journal: V. Petrauskas, S. Skyabene, O. Balkyavichene, "The 30th Anniversary of the Journal TRUDY AKADEMII NAUK LITOVSKOY SSR," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 1 (146), 1985, pp 150-152) the Central Archives, the House of Scientists,

--13 councils--the Republic Council for the Coordination of Scientific Activity in the Natural and Social Sciences, the Editing and Publishing Council, the Council for Terminology, the Council for the Automation of Scientific Research, the Council for Scientific and Technical Information, the Patent and License Council, the Council of Philosophical (Methodological) Seminars, the Council for Applied Problems, the Republic [of the Academy of Sciences and the Lithuanian SSR Ministry of Higher and Secondary Specialized Education] Council for the Coordination of Information on the Achievements of Science, the Council of Centers of the Collective Use of Instruments, the Republic [of the Academy of Sciences and the Lithuanian SSR State Planning Committee] Scientific Council for Problems of Scientific, Technical, and Socioeconomic Forecasting, the Republic [of the Lithuanian SSR State Planning Committee and the Academy of Sciences] Council for Economic Problems, the Public Scientific Methods Council for the Study of the Problems of Improving the Organization of Socialist Competition of the Academy of Sciences and the Latvian Republic Council of Trade Unions,

--12 commissions--the Commission for Exhibitions, the Commission for Nature Conservation, the Commission for the Development and Introduction of Computer Technology, the Commission for Scientific Instrument Making, the Commission

for Socialist Competition, the Commission for Bonuses for the Development and Introduction of New Equipment, the Commission for the Study of Questions of Agriculture, the Commission for Atomic Energy, the Commission for the Study of Industrial Robots, the Commission for Comprehensive Cooperation Between the Academy of Sciences and the City of Shyaulyay, the Commission for Work With Young People, the Commission of the Lithuanian Language (the chairman is Doctor of Philological Sciences Professor Yonas Palenis), (Footnote 2) (See: "In the Republic Commission of the Lithuanian Language," SOVETSKAYA LITVA, No 49 (12362), 25 February 1984, p 4)

--16 scientific societies (2 republic societies, 14 department-affiliates of all-union societies).

Seven specialized councils for the defense of doctoral and candidate dissertations operated at the institutes of the Academy of Sciences: the Institute of Chemistry and Chemical Technology (doctors of sciences)--the specialties "Electrochemistry" and "Physical Chemistry," the Institute of Biochemistry (candidates of sciences)--the specialties "Biochemistry" and "Cytology," the Institute of Botany (candidates of sciences)--the specialties "Botany" and "Plant Physiology," the Institute of Physical and Technical Problems of Energetics (candidates of sciences)--the specialties "The Theory of Heat Technology," "Industrial Heat and Power Engineering," and "Thermal Physics," the Institute of History (candidates of sciences)--the specialties "The History of the USSR" and "Archeology," the Institute of Economics (candidates of sciences)--the specialty "The Economics of the National Economy, Management, Planning," the Institute of Philosophy, Sociology, and Law (doctors of sciences)--the specialty "The History of Philosophy."

Personnel. On 31 December 1984 there were at the Academy of Sciences 23 full members and 31 corresponding members, including 2 corresponding members of the USSR Academy of Sciences and 1 full member (academician) (at the session of the General Assembly of the USSR Academy of Sciences on 26 December 1984 President of the Lithuanian SSR Academy of Sciences Yu. Pozhela was elected a full member (academician) of the USSR Academy of Sciences in the specialty "The Element Base, the Materials of Computer Technology, and Diagnostics").

In all 4,956 people, including 1,855 scientific associates (107 doctors of sciences and 924 candidates of sciences), were working at the Academy of Sciences.

On 26 May 1984 Academician Zigmas Yanushkyavichyus died, (Footnote 3) (See: "Zigmas Januskevicius (1911-1984)," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 1 (89), 1985, pp 105-109) on 7 October 1984 Corresponding Member of the USSR Academy of Sciences Yonas Bulavas died. (Footnote 4) (See: "Jonas Bulavas (1903-1984)," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 2 (90), 1985, pp 135-137)

In 1984, 9 doctoral dissertations (E. Shpilevskiy (the Institute of Mathematics and Cybernetics), G. Pragarauskas (the Institute of Mathematics and Cybernetics), V. Shneyder (the Institute of Semiconductor Physics), A. Ambrazyavichyus (the Institute of Physical and Technical Problems of Energetics), M. Tamonis (the Institute of Physical and Technical Problems of

Energetics), A. Lugauskas (the Institute of Botany), M. Meshkauskene (the Institute of Economics), A. Gaydis (the Institute of Philosophy, Sociology, and Law), B. Kuzmitskas (the Institute of Philosophy, Sociology, and Law)) and 58 candidate dissertations were defended.

Table 1. Associates of the Institutions of the Lithuanian SSR Academy of Sciences on 31 December 1984

Institution	Total	Scientists	Academicians	Corresponding members	Doctors of sciences	Candidates of sciences	Graduate students
Institution of Mathematics and Cybernetics	452	191	1	3	11	92	40
Institute of Physics..	533	191	2	2	7	80	18
Institute of Semiconductor Physics.....	648	148	-	1	12	81	17
Institute of Physical and Technical Problems of Energetics.....	718	242	-	3	10	91	30
Institute of Chemistry and Chemical Technology.....	629	225	1	1	8	146	13
Institute of Biochemistry.....	253	128	-	4	7	81	12
Institute of Botany...	380	135	1	-	3	74	32
Institute of Zoology and Parasitology (with the Department of Geography).....	368	200	1	1	11	105	31
Institute of Economics	172	106	2	-	6	50	34
Institute of History..	111	75	1	2	9	34	10
Institute of Philosophy, Sociology, and Law (with the Center of Scientific Information on the Social Sciences).....	117	102	-	-	5	35	10
Institute of the Lithuanian Language and Literature.....	112	79	1	2	11	41	6
Central Library of the Academy of Sciences...	141	1	-	-	-	1	-
Presidium of the Academy of Sciences and its Central Staff.....	130	14	6	1	6	6	-
Transportation Department.....	91	-	-	-	-	-	-
Experimental base.....	48	-	-	-	-	-	-

[Table continued on following page]

Institution	Total	Scientists	Academicians	Corresponding members	Doctors of sciences	Candidates of sciences	Graduate students
Editorial Office of the journal TRUDY AKADEMII NAUK LITOVSKOY SSR.....	10	-	-	-	-	-	-
Philosophy Chair.....	6	5	-	-	1	4	-
Foreign Languages Chair.....	14	13	-	-	-	3	-
House of Scientists..	23	-	-	-	-	-	-
Total.....	4956	1855	16*	20*	107	924	253

*Seven academicians and 11 corresponding members work at other scientific institutions and higher educational institutions of the republic.

On 7 February 1984 Academician V. Statulyavichyus was elected chairman of the Board of the Lithuanian SSR Society for Knowledge.

The Party Organization. On 31 December 1984 there were at the Academy of Sciences 15 party organizations, in which there were 459 communists.

At the 13 sessions of the party committee the following most important questions of ideological, party organizational, and scientific production work were discussed: the activity of the party organization of the Institute of Botany on the improvement of the work of graduate studies; the role of the party organization of the Institute of Semiconductor Physics in the development of the activity of the Elektronika Scientific Production Complex; the activity of the Komsomol Committee of the Academy of Sciences on the fulfillment of the decrees of the 26th CPSU Congress and the 18th Lithuanian CP Congress; the implementation of the critical remarks, which were made in the speech of First Secretary of the Lithuanian CP Central Committee P. Grishkyavichus, which was made at the meeting to hear reports of the party organization (Footnote 5) (See the speech of First Secretary of the Lithuanian CP Central Committee P. Grishkyavichus at the meeting of the party organization of the Academy of Sciences on 13 October 1983: "Reports and Elections in Party Organizations. Strengthen the Contact of Science With Production," SOVETSKAYA LITVA, No 236 (12249), 14 October 1983, pp 1-2) of the Academy of Sciences, as well as at the meetings of the party organizations of the institutes of the Academy of Sciences; the activity of the party organization of the Institute of Philosophy, Sociology, and Law on the selection and reelection of scientists, on the preparation of a reserve of personnel, and the promotion of young people to management work in the Institute of Biochemistry; the activity of the philosophical methodological seminars at the institutes of the Physical, Technical, and Mathematical Sciences Department; the practice of organizing "Days of Science" in Moletskiy Rayon. Questions of production engineering and public cooperation were discussed jointly with the party committee of the Vilnius Drill Plant.

The Komsomol Organization. On 31 December 1984, 14 primary Komsomol organizations, in which there were 697 Komsomol members, were in operation at the Academy of Sciences.

At the 7th Komsomol Conference of the Academy of Sciences, which was held on 29 October 1984, a new Komsomol Committee of the Academy of Sciences was elected: Ya. Alyanovich (the Institute of Chemistry and Chemical Technology), A. Audziyonite (the Presidium of the Academy of Sciences), Y. Vegele (the Institute of Zoology and Parasitology), V. Gaydis (the Institute of Philosophy, Sociology, and Law), S. Gintautas (the Institute of Physics), E. Gudzhinskas (the Institute of Mathematics and Cybernetics), A. Dobravolskas (the Institute of Economics), A. Dyaringis (the Institute of Physics), V. Yelinskas (the Presidium of the Academy of Sciences), S. Lapenis (the Institute of Mathematics and Cybernetics), A. Mitskene (the Presidium of the Academy of Sciences), V. Monkus (the Institute of Mathematics and Cybernetics), S. Pakalnishkis (the Institute of Zoology and Parasitology), Sh. Pilka (the Institute of Botany), K. Pozhela (the Institute of Semiconductor Physics), V. Stanyalyunas (the Institute of Economics), D. Shidlaushayte (the Institute of Chemistry and Chemical Technology), K. Yasyunas (the Institute of Physics), I. Yatsunska (the Institute of Economics). Saulyus Lapenis was elected secretary of the committee for a second term.

Awards, Prizes. Academician Yu. Matulis was awarded the Order of Friendship of Peoples.

The honorary title of Honored Figure of Science and Technology of the Lithuanian SSR was conferred on Corresponding Member of the Academy of Sciences D. Eydukas. The honorary title of Honored Journalist of the Lithuanian SSR was conferred on Yu. Lautsyus, editor in chief of the journal of the Academy of Sciences MOKSLAS IR TEKHNIKA. The honorary title of Honored Worker of Cultural and Educational Work of the Lithuanian SSR was conferred on R. Vyantskyavichyus, scientific secretary of the Editing and Publishing Council.

Honorary certificates of the Presidium of the Lithuanian SSR Supreme Soviet were awarded to: Sh. Gaylyavichene, chief of a sector of the Central Library; V. Galinis, senior scientific associate of the Institute of the Lithuanian Language and Literature; Corresponding Member of the Academy of Sciences A. Prokonchik; K. Yankyavichyus, chief of a laboratory of the Institute of Botany.

For the development and introduction in production of highly efficient technologies of the application of nickel, zinc, conversion, and chrome coatings Academician Yu. Matulis, Director of the Institute of Chemistry and Chemical Technology Academician R. Vishomirskis, and institute associates P.-R. Dobrovolskis, A. Bodnevas, M. Mitskus, R. Sharmaytis, Yu. Vegis, A. Petrauskas, and S. Yakobson (along with other scientists and production workers of the republic) were awarded the 1984 Prize of the USSR Council of Ministers for the performance of complex scientific research, planning, design, and technological work in the most important directions of the development of the national economy and its sectors and for the introduction of the obtained results. (Footnote 6) ("Through Labor There Is Also Honor,"

SOVETSKAYA LITVA, No 108 (12421), 8 May 1984, p 3; "The Victory of Chemists," VECHERNIYE NOVOSTI, No 108 (8018), 12 May 1984, p 1; "Mosklo naujovems--'zolioji gatve' [Interviu su akad. R. Visomirskiu]," KAUNO TIESA, No 115 (11399), 19 geg. 1984, p 2; "The Prizes of the USSR Council of Ministers Have Been Presented," SOVETSKAYA LITVA, No 164 (12477), 17 July 1984, p 1)

Lithuanian SSR State Prizes in Science and Technology were awarded to: S. Alishauskas, senior scientific associate of the Institute of Physics; A. Ambrazyavichyus, chief of a laboratory of the Institute of Physical and Technical Problems of Energetics; V. Makaryavichyus, deputy director of the Institute of Physical and Technical Problems of Energetics; M. Tamonis, chief of a laboratory of the Institute of Physical and Technical Problems of Energetics; A. Sabalyauskas, senior scientific associate of the Institute of the Lithuanian Language and Literature. (Footnote 7) (See: "In the Central Committee of the Communist Party of Lithuania and the Lithuanian SSR Council of Ministers. On the Awarding of the 1984 Lithuanian SSR State Prizes in Science, Technology, Literature, and Art," SOVETSKAYA LITVA, No 164 (12481), 21 July 1984, pp 1, 3)

The USSR Academy of Sciences awarded the memorial medal on the occasion of the 100th anniversary of the birth of Academician Ye. Pavlovskiy for the contribution to the study of the problem of natural focal diseases to members of the collective of the Institute of Zoology and Parasitology--Academician V. Kontrimavichyus, Doctor of Medical Sciences S. Bizyulyavichyus, and Candidate of Biological Sciences T. Ariastauskene.

The Academician Prantsishkus Shivitskis Prize for a large contribution of experimental zoology (Decree No 23 of the Presidium of the Lithuanian SSR Academy of Sciences of 23 April 1984) was awarded to Candidate of Biological Sciences Y. Manyuskas (the Institute of Zoology and Parasitology).

The Presidium of the Board of the Society for Knowledge of the Lithuanian SSR awarded to Academician P. Slavenas the 1984 Antanas Snechkus Prize for great services in the matter of the development of the promotion of political and scientific knowledge and the communist education of workers.

Sessions of the General Assembly of the Academy of Sciences. The annual report session of the General Assembly of the Academy of Sciences, at which the report on the activity of the Academy of Sciences in 1983 was discussed and the consolidated plan of the scientific research being conducted and coordinated by the Academy of Sciences for 1984 was approved, was held on 29 February 1984. (Footnote 8) (See: V. Petrauskas, S. Skyabene, O. Balkyavichene, "The Annual Report Session of the General Assembly of the Lithuanian SSR Academy of Sciences (29 February 1984)," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 3 (142), 1984, pp 133-140. Also see: Y. Samaytis, V. Petrauskas, V. Redaytis, "The Activity of the Lithuanian SSR Academy of Sciences in 1983," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 2 (147), 1985, pp 103-123)

The extraordinary session of the General Assembly of the Academy of Sciences, at which Academician Yuras Pozhela was elected president of the Lithuanian SSR Academy of Sciences, Academician Vitautas Kontrimavichyus was elected

academician secretary of the Chemical, Technological, and Biological Sciences Department, Corresponding Member Yonas Matsyavichyus was elected academician secretary of the Social Sciences Department, and V. Kontrimavichyus, who was elected by the department, was approved as director of the Institute of Zoology and Parasitology, was held on 26 June 1984. (Footnote 9) (See: (ELTA). "The Elections in the Lithuanian SSR Academy of Sciences," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 6 (145), 1984, p 162; T. Sidorenko, Y. Samaytis, V. Petrauskas, "The Extraordinary Session of the General Assembly of the Lithuanian SSR Academy of Sciences (26 June 1984)," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 1 (146), 1985, pp 125-134)

Meetings of the Presidium of the Academy of Sciences. There were 64 meetings of the Presidium (of them 8 plenary meetings), at which the following most important questions were discussed:

--the basic directions of the scientific research of the Institute of Economics (Footnote 10) (The Presidium of the Lithuanian SSR Academy of Sciences revised the basic direction of the scientific research of the Institute of Economics by Decree No 324 of 15 October 1984, "On the Basic Direction, Profile, and Structure of the Institute of Economics" [See: Y. Samaytis, "The Basic Scientific Direction, Profile, and Structure of the Institute of Economics Have Been Revised," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA A, Vol 2 (91), 1985, pp 139-141], in fulfilling the instructions and the tasks, which the Buro of the Lithuanian CP Central Committee posed for the institute during the discussion of the question of increasing the role of the Institute of Economics in solving the most important problems of the economic development of the republic [See: "In the Buro of the Lithuanian CP Central Committee," SOVETSKAYA LITVA, No 149 (12462), 29 June 1984, p 1]) and the Institute of Botany (Footnote 11) (The basic directions of the scientific research of the Institute of Botany were revised by Decree No 6 of the Presidium of the Lithuanian SSR Academy of Sciences of 9 January 1984, "On the Basic Directions of the Scientific Research and the Problems of the Institute of Botany," after the adoption of which the total number of basic directions of scientific research of the Academy of Sciences became 19 (instead of 18) [see footnote 20]);

--the drafting of republic comprehensive scientific, technical, and socioeconomic programs for 1986-1990 and the period to 2000;

--the further increase of the economic effectiveness of the introduction of the results of scientific research; the further increase of the efficiency of the use of computer technology at the institutes of the Academy of Sciences;

--the scientific and the scientific organizational activity of the Institute of Physical and Technical Problems of Energetics in 1978-1982, (Footnote 12) (See: Ch. Sipavichyus, V. Petrauskas, "The Activity of the Institute of Physical and Technical Problems of Energetics in 1978-1982," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 4 (143), 1984, pp 147-157) the Institute of Semiconductor Physics in 1979-1983, (Footnote 13) (See: Y. Samaytis, V. Petrauskas, "The Activity of the Institute of Semiconductor Physics in 1979-1983," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 3 (148), 1985, pp 132-139) the Institute of Biochemistry in 1978-1982, (Footnote 14) (See:

Y. Samaytis, V. Petrauskas, "The Activity of the Institute of Biochemistry in 1978-1982," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 3 (91), 1985, pp 133-138) the Institute of Philosophy, Sociology, and Law in 1979-1983. (Footnote 15) (See: P. Dichyus, "The Activity of the Institute of Philosophy, Sociology, and Law in 1979-1983," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA A, Vol 2 (91), 1985, pp 147-153)

In execution of Decree No 344 of the Presidium of the Lithuanian SSR Academy of Sciences of 30 November 1983, "On the Positive Experience of Institutes, Laboratories, and Departments on the Introduction of Completed Scientific Work and the Broadening of Cooperation With Production Organizations," information reports of the boards of directors of the Institute of Chemistry and Chemical Technology, the Institute of Physical and Technical Problems of Energetics, the Institute of Botany, the Institute of Biochemistry, the Institute of Mathematics and Cybernetics, the Institute of Semiconductor Physics, and the Institute of Physics on the activity of the institutes in this area were heard at the expanded plenary meetings of the Presidium of the Academy of Sciences.

In all 423 decrees, 52 decisions, and 174 orders were adopted.

The Sessions of the General Assemblies of the Departments of Sciences and the Meetings of the Bureaus of the Departments. Sessions of the general assemblies of all three departments of sciences, at which the scientific and the scientific organizational activity of the institutes of the departments in 1984, the plans of scientific research for 1985, and the reports of academicians and corresponding members of the Academy of Sciences were discussed, were held.

There were seven meetings of the Bureau of the Physical, Technical, and Mathematical Sciences Department. The prospects of the development of the Computer Center of the Academy of Sciences and the increase of the efficiency of the use of computer technology at institutes of the biological and social sciences type, the organization of an interdepartmental laboratory for the registration of the pollution of the air basin of the republic, the training of highly skilled scientists, and other questions were discussed.

There were 12 meetings of the Bureau of the Chemical, Technological, and Biological Sciences Department. The specialization of the subdivisions of the Institute of Zoology and Parasitology, the Institute of Biochemistry, and the Institute of Botany, the strengthening of contacts with production organizations and the establishment of scientific production complexes and associations--Galvanotekhnika and Rybovodstvo, the coordination of the research being conducted at preserves and other protected territories of the Lithuanian SSR, the preparation of a new edition of "Krasnaya kniga Litovskoy SSR" [The Red Book of the Lithuanian SSR], proposals on the intensification of fish breeding by the use of the heated waters of the Ignalinskaya AES, the increase of the productivity of soils and the broadening of studies of questions of soil erosion, and other questions were discussed.

There were 23 meetings of the Bureau of the Social Sciences Department. The organization of scientific research on questions of Soviet construction and socialist democracy in light of the decisions of the April (1984) CPSU Central

Committee Plenum, the intensification of propaganda and counterpropaganda, the intensification of scientific research in the field of the history of science and technology in Lithuania, the stimulation of the study of urgent economic problems, the development of basic research in cooperation with the scientific institutions of the USSR Academy of Sciences, production organizations, and higher educational institutions, and other questions were discussed.

The All-Union Seminar-Conference on Questions of the Increase of the Efficiency of the Introduction of the Results of Scientific Research (On the Basis of the Example of the Activity of the Institute of Chemistry and Chemical Technology of the Lithuanian SSR Academy of Sciences) was held in Vilnius on 5-7 March 1984. (Footnote 16) (On the seminar see: N. Kharitonova, Y. Samaytis, V. Petrauskas, "Increase the Efficiency of the Introduction of the Results of the Scientific Research of Academic Institutes," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 1 (146), 1985, pp 140-147. Also see: A. Ramanauskas, V. Petrauskas, V. Redaytis, "The Strengthening of the Contacts of the Lithuanian SSR Academy of Sciences With Production and the Acceleration of the Introduction of the Results of the Scientific Research of Its Institutes in Practice," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 3 (142), 1984, pp 110-126; A. Ramanauskas, V. Petrauskas, "The Experience of the Institute of Chemistry and Chemical Technology in the Introduction in Production of the Results of Scientific Research," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 2 (141), 1984, pp 93-100) The seminar was convened by the Council for the Coordination of the Scientific Activity of the Academies of Sciences of the Union Republics attached to the Presidium of the USSR Academy of Sciences, the Presidium of the Lithuanian SSR Academy of Sciences, and the Central Committee of the Education, Higher Schools and Scientific Institutions Workers Union. Vice presidents, chief scientific secretaries of the presidiums, academician secretaries of the departments of the academies of sciences of the union republics, representatives of the Coordinating Council of the USSR Academy of Sciences, as well as representatives of the Central Committee of the Education, Higher Schools and Scientific Institutions Workers Union and representatives of the republic trade union committees took part in its work.

Reports were delivered at the seminar by Academician Yu. Matulis ("On the Forms of Cooperation of Academic Institutes With Production in the Lithuanian SSR") and Director of the Institute of Chemistry and Chemical Technology Academician R. Vishomirskis ("On the Experience of the Organization of the Introduction of Completed Scientific Developments of the Institute of Chemistry and Chemical Technology of the Lithuanian SSR Academy of Sciences").

Vice President of the USSR Academy of Sciences V. Kotelnikov, director of the seminar, presented the Challenge Red Banner of the CPSU Central Committee, the USSR Council of Ministers, the All-Union Central Council of Trade Unions, and the All-Union Komsomol Central Committee to the collective of the Institute of Chemistry and Chemical Technology as the winner in the 1983 all-union socialist competition in the natural and technical sciences.

The seminar approved of the activity of the Institute of Chemistry and Chemical Technology and recommended its experience for dissemination. (Footnote 17) (The reports of Yu. Matulis (pp 30-34) and R. Vishomirskis (pp 34-41) at the seminar are paraphrased, the course of the seminar and the

discussions are described (pp 29-30, 41-47), and the decree of the seminar is paraphrased (p 47) in the organ of the Presidium of the USSR Academy of Sciences in No 9, 1984 of the journal VESTNIK AKADEMII NAUK SSSR (pp 29-47) in the publication "The Increase of the Efficiency of the Use of the Results of Scientific Research. The Seminar-Conference in Vilnius")

On 7 March First Secretary of the Lithuanian CP Central Committee P. Grishkyavichus met with Vice President of the USSR Academy of Sciences Academician V. Kotelnikov. During the conversation Academician V. Kotelnikov noted that the achievements of the institutes of the Lithuanian SSR Academy of Sciences in the matter of introducing the results of scientific research in practice are appreciated in the country and that they, in working on several important problems, have become the leading ones in the country. (Footnote 18) (See: "The Meeting in the Central Committee of the Communist Party of Lithuania," SOVETSKAYA LITVA, No 60 (12373), 8 March 1984, p 1)

On 29 May 1984 V. A. Medvedev, chief of the Science and Educational Institutions Department of the CPSU Central Committee, visited the Academy of Sciences. He acquainted himself with the House of Scientists and the activity of the Institute of Semiconductor Physics and met with members of the Presidium of the Academy of Sciences and directors of institutes of the Academy of Sciences. Secretary of the Lithuanian CP Central Committee L. Shepetis, Deputy Chairman of the Lithuanian SSR Council of Ministers A. Chesnavichyus, and Chief of the Science and Educational Institutions Department V. Baltrunas took part in the meeting.

On 25-27 June 1984 Academician A.M. Prokhorov, a member of the Presidium of the USSR Academy of Sciences, academician secretary of the General Physics and Astronomy Department, and director of the Institute of General Physics, visited the Academy of Sciences. He took part in the extraordinary session of the General Assembly of the Lithuanian SSR Academy of Sciences and spoke at it, (Footnote 19) (See the source indicated in footnote 9) and acquainted himself with the activity of the Institute of Semiconductor Physics and the Institute of Physics.

The basic directions of the scientific research of the Academy of Sciences (Footnote 20) (See the full formulations of the basic directions of the scientific research of the Academy of Sciences: M. Rimkyavichene, "The Activity of the Lithuanian SSR Academy of Sciences in 1976," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 3 (106), 1978, pp 116-118. Also see the sources (for the Institute of Economics and the Institute of Botany), which are indicated in footnotes 10 and 11) is 1984 were the following:

1. Probability theory and its application for problems of management (the Institute of Mathematics and Cybernetics). 2. The automation of scientific research (the Institute of Mathematics and Cybernetics). 3. The basic questions of theoretical and mathematical physics (the Institute of Physics). 4. Theoretical and experimental spectroscopy (the Institute of Physics). 5. Atmospheric physics (the Institute of Physics). 6. Semiconductor physics and chemistry (the Institute of Semiconductor Physics). 7. The development

of instruments and equipment (the Institute of Semiconductor Physics). 8. The physical and technical problems of energetics (the Institute of Physical and Technical Problems of Energetics);

9. The physical chemical problems of electroplating (the Institute of Chemistry and Chemical Technology). 10. The biochemical and genetic principles of the functioning of the cell and the directed synthesis of cytoactive compounds (the Institute of Biochemistry). 11. The laws of the functioning and productivity of the species and phytocenoses and their efficient use for the improvement of the fodder base (the Institute of Botany). 12. Hereditary information and the physiological and biochemical principles of its implementation in plant growing and biotechnology (the Institute of Botany). 13. The laws of the functioning and productivity of the species and zoocenoses and their efficient use (the Institute of Zoology and Parasitology). 14. The biological principles of the increase of the productivity and the efficient use of inland bodies of water (the Institute of Zoology and Parasitology). 15. Contemporary physical geographic processes and the scientific principles of the formation, the efficient use, the protection, and the forecasting of the development of the natural environment of the Baltic Sea and the territory of the Lithuanian SSR (the Department of Geography of the Institute of Zoology and Parasitology);

16. The theoretical questions of expanded socialist reproduction, the increase of the efficiency of social production, the improvement of its management, and forecasting (the Institute of Economics). 17. The interaction of mature socialist society and the individual under the conditions of the present scientific and technical revolution (the Institute of Philosophy, Sociology, and Law). 18. The laws of the historical development of the Lithuanian people (the Institute of History). 19. The laws of the development and functioning of the Lithuanian language, literature, and folklore (the Institute of the Lithuanian Language and Literature).

The Material and Technical Base (see Tables 2 and 4). In 1984 the total outlays of the Academy of Sciences came to 21 million rubles, including wages--8.19 million rubles, scientific research work--6.4 million rubles, the acquisition of apparatus and equipment--3.5 million rubles. The income from economic contractual operations came to 10 million rubles, the expenditures came to 8.5 million rubles.

The capital investments came to 4.97 million rubles, of them construction and installation work came to 1.6 million rubles. In 1984 there were put into operation: the Laboratory Building of the Institute of Mathematics and Cybernetics (4,720 square meters of working area), the Station for the Study of Sea and Air Pollution in the settlement of Preyla of the Institute of Physics (140 square meters), the Dining Room of the Institute of Physics (seating for 60), and the Warehouse of the Academy of Sciences (460 square meters), the construction of the Pilot Industrial Base for the Production of Antileucosis Compounds of the Institute of Biochemistry, the Republic Nursery of Experimental Animals of the Institute of Biochemistry, and the Laboratory of Heat Exchange and the Hydrodynamics of Nuclear Reactors of the Institute of Physical and Technical Problems of Energetics was begun.

In 1984, 11 organizations made up the pilot production base of the Academy of Sciences: the Experimental Plant of Assemblies of Computerized Instruments and Software and the Experimental Production Department (the Institute of Mathematics and Cybernetics), the Pilot Plant of Laser and Electronic Engineering and the Experimental Works (the Institute of Physics), the Pilot Plant and the Experimental Works (the Institute of Semiconductor Physics), the Experimental Works (the Institute of Physical and Technical Problems of Energetics), the Pilot Experimental Base (the Institute of Chemistry and Chemical Technology), the Experimental Production Section (the Institute of Biochemistry), the Experimental Base (the Inctitute of Botany), and the Experimental Base (the Institute of Zoology and Parasitology). In all 900 people worked at them. The total amount of work and services, which were performed by these organizations in 1984, came to 2.8 million rubles.

The Coordination of Basic Scientific Research. The Republic Council for the Coordination of Scientific Activity in the Natural and Social Sciences attached to the Presidium of the Academy of Sciences supervised 28 problem scientific councils, of which more than 650 most prominent scientists and specialist of the republic, among whom there are more than 150 doctors of sciences, were members.

The study of more than 660 themes on 46 problems was envisaged in the approved consolidated coordinating plan of scientific research for 1984. The Academy of Sciences fulfilled about 320 themes, the Ministry of Higher and Secondary Specialized Education--330, other ministries and departments--70. In 1984 the study of more than 140 new themes was begun and about 140 were completed. About 300 themes are scientific and technical themes and more than 360 themes are basic research. In 1984 the proportion of basic research in the themes of sectorial scientific research institutes increased.

The Fulfillment of Comprehensive Programs. In 1984, 10 institutes of the Academy of Sciences (except the Institute of History and the Institute of the Lithuanian Language and Literature) fulfilled 40 comprehensive programs (studied 137 themes), including all-union programs (65 themes) and 10 republic programs (39 themes). The institutes of the Academy of Sciences supervised the fulfillment of 11 programs (4 republic and 7 interdepartmental). The largest number of themes, which are included in the programs, were fulfilled by: the Institute of Physical and Technical Problems of Energetics--31, the Institute of Zoology and Parasitology--22, the Institute of Physics--21, the Institute of Semiconductor Physics--19, the Institute of Biochemistry--18. The largest number of themes, which are included in the programs, were completed by the Institute of Biochemistry--90 percent (of the total number of themes being worked on), the Institute of Physical and Technical Problems of Energetics--79.5 percent, the Institute of Zoology and Parasitology--78 percent, the Institute of Semiconductor Physics--70 percent, the Institute of Physics--50 percent.

The Basic Results of the Scientific Activity of the Academy of Sciences. In 1984 the institutes of the Academy of Sciences elaborated 637 themes (200 basic themes, 437 scientific and technical themes, of them 289 economic contractual themes). The elaboration of 290 themes (81 basic themes,

209 scientific and technical themes, of them 177 economic contractual themes) was completed (see Tables 2 and 3).

Table 2. The Basic Indicators of the Activity of the Lithuanian SSR Academy of Sciences in 1982-1982

Indicator	1982	1983	1984
1. Comprehensive programs fulfilled (total)	44	39	40
1.1. All-union	22	22	23
1.2. Republic	15	10	10
1.3. Interdepartmental	7	7	7
1.4. Programs supervised by institutes of the Academy of Sciences	13	11	11
2. Themes fulfilled (total)	572	608	637
2.1. Basic	176	195	200
2.2. Scientific and technical (total)	396	413	437
2.2.1. Budget-carried	141	142	148
2.2.2. Economic contractual	255	271	289
3. Study of themes completed (total)	268	300	290
3.1. Basic	78	88	81
3.2. Scientific and technical (total)	190	212	209
3.2.1. Budget-carried	49	56	32
3.2.2. Economic contractual	141	156	177
4. Total (accumulated over 5 years) economic impact from the introduction of research results (thousands of rubles).	34600	40793	41800
5. Contracts on creative cooperation fulfilled (on 31 December)	337	325	368
6.1. Publications issued	173	173	164
6.2. Their size (publisher's signatures)	1919	1794	1777
7.1. Applications for inventions submitted	165	144	150
7.2. Positive decisions received	82	91	79
7.3. Certificates of authorship received	101	87	109
8. Conferences and meetings organized (total)	13	11	11
8.1. All-union	7	3	8
9. Field trips organized	89	155	90
10.1. Public lectures given	3679	4279	3525
10.2. Popular science articles published	810	947	771
10.3. "Days of Science" organized	27	13	10
11.1. Foreign specialists who visited	154	152	118
11.2. Number of foreign business trips	106	94	99
12. Number of laboratories (departments) (on 31 December).	156	159	159
13. Total number of workers (on 31 December)	4765	4866	4956
13.1. Scientists (total)	1805	1811	1855
13.2. Doctors of sciences	87	95	107
13.3. Candidates of sciences	878	897	924
14. Number of graduate students (total) (on 31 December)	245	245	253
14.1. Resident	103	99	107
14.2. In special-purpose graduate studies of scientific centers of the country	29	17	17

[Table continued on following page]

Indicator	1982	1983	1984
14.3. Graduate students admitted (total).....	71	67	65
14.3.1. Resident.....	35	26	25
14.3.2. To special-purpose graduate studies at scientific centers of the country.....	12	5	4
14.4. Graduate students graduated (total).....	62	59	70
14.4.1. Resident.....	29	27	32
14.4.2. From special-purpose graduate studies at scientific centers of the country.....	11	5	4
15.1. Doctoral dissertations defended.....	8	7	9
15.2. Candidate dissertations defended.....	50	68	58
16. Capital investments (total) (thousands of rubles).....	2943	933	4973
16.1. Construction and installation work.....	1153	492	1606
16.2. Placement of fixed capital into operation.....	2350	---	5454
17. Total expenditures (thousands of rubles).....	19774	20471	22096
17.1. Wages (item 1).....	8094	8011	8185
17.2. Scientific research work (item 5).....	5463	6244	6410
17.3. Acquisition of apparatus and equipment (item 12)....	3112	3198	4150
18.1. Revenues from economic contracts (thousands of rubles).....	8245	9918	10833
18.2. Outlays on economic contracts (thousands of rubles).	7897	8107	8890

Table 3. The Number of Scientific Themes Studied and Completed by Institutes of the Lithuanian SSR Academy of Sciences in 1984

Institute	Themes studied				Study of themes completed			
	total	basic	scientific and technical		total	basic	scientific and technical	
			budget carried	economic contractual			budget carried	economic contractual
Institute of Mathematics and Cybernetics.....	50	15	12	23	19	1	3	15
Institute of Physics.....	70	22	24	24	8	1	2	5
Institute of Semiconductor Physics.....	74	16	13	45	34	7	2	25
Institute of Physical and Technical Problems of Energetics.....	102	19	21	62	41	4	6	31
Institute of Chemistry and Chemical Technology.....	144	30	31	83	103	37	8	58

[Table continued on following page]

Institute	Themes studied: total	basic	scientific and technical: budget carried	scientific and technical: economic contractual	Study of themes completed: total	basic	scientific and technical: budget carried	scientific and technical: economic contractual
Institute of Biochemistry....	25	9	12	4	6	3	-	3
Institute of Botany.....	38	6	8	14	26	2	-	24
Institute of Zoology and Parasitology (with Department of Geography)...	36	10	15	11	16	3	5	8
Institute of Economics.....	29	16	9	4	11	3	4	4
Institute of Philosophy, Sociology, and Law (with Center of Scientific Information on the Social Sciences)..	21	15	3	3	4	2	2	-
Institute of History.....	28	22	-	6	15	11	-	4
Institute of the Lithuanian Language and Literature.....	20	20	-	-	7	7	-	-
Total.....	637	200	148	289	290	81	32	177

Further the most important results of the scientific research performed by the institutes of the Academy of Sciences in 1984 are cited in brief.

The Institute of Mathematics and Cybernetics (IMK)

The central limit theorem for random walk in a random medium on the condition that the walk is a martingale, was proven.

The criterion of the weak convergence of probability measures, which correspond to random processes with values in the domain of piecewise smooth boundaries, was found; the criterion was applied to the approximation of random processes in the theory of loaded open networks of queueing systems.

A metric approach was developed and new estimates were obtained in limit theorems for dependent random values in finite- and infinite-dimensional spaces.

A method of constructing and studying difference diagrams for nonlinear differential equations with a nonlocal (integral) condition, which are encountered in vibration engineering and microelectronics, was developed. By means of a computer experiment the effect of the localization of a diffusing substance in a solid was studied and the possibility of the use of this effect in the technology of integrated circuits was indicated.

Sets of proposals, from which there directly follows the optimum method on the average for seeking the global minimum of continuous functions, as well as a method for finding the minimum of unimodal functions, which are calculated with errors, were elaborated. An improved version of the FORTRAN portable package of programs for the solution of continuous problems of optimization, was developed on this basis.

The Institute of Physics (IF)

A general algebraic expression for the average energy of the spectrum of the radiation of an atom with any number of vacant shells was obtained.

A number of simple algebraic expressions for the matrix elements of operators of energy in case of the basic and a number of other terms of the L- and f-shells were found. A simple formula, which describes the width of the energy spectrum of atoms and ions with one vacant electron shell, was obtained.

A method and software for the modeling of atomic processes in thermonuclear plasma and of spectra of the radiation losses of the plasma of a tokamak were developed.

The possibility of the occurrence of interparticle correlation through wave processes in a medium was predicted theoretically. It was shown that the excitations of a medium can influence noise much more strongly than the response, which creates the basis of the development of the fluctuation spectroscopy of a medium.

The generation of colliding femtosecond light pulses in case of the synchronization of their modes with allowance made for the variance of the phase response of a medium was studied theoretically.

The nonlinear addition to the indicator of the refraction of a number of laser active media, which contain neodymium, was measured experimentally.

A method for the simultaneous determination of the metallicity and carbonaceousness of low-temperature stars on the basis of their photometric data in accordance with the Vilnius seven-color system was developed.

A technological process of the laser drilling of pipes was developed and industrial tests were conducted.

A method of determining the penetration of ozone from the stratosphere into the surface layer of the atmosphere by the measurement of a set of cosmogenic and artificial radionuclides was developed.

The space-time distribution of chemical contaminants over the Baltic Sea was determined. A mock-up of an instrument for the measurement of the dispersion of submicron aerosol was developed and tested.

The Institute of Semiconductor Physics (IFP)

The translucence of a form in the vicinity of cyclotron resonance in strong electromagnetic field was predicted theoretically.

It was predicted that time lag of the heat-up of electrons under the conditions of collision ionization can lead to the occurrence of negative dynamic conduction starting with frequencies on the order of 100 gigahertz.

A new orientation of a gallium arsenide crystal with the highest speed of the propagation of surface acoustic waves of the Rayleigh type and with the highest values of the electromechanical coupling constant was discovered.

A method for studying the dynamics of the electrical conductance of semiconductors with a time resolution of 50 picoseconds on exposure to picosecond electron beams, light pulses, and constant and microwave electric fields was developed.

Low-inertial semiconductor sensors of pulse pressure were developed.

The Institute of Physical and Technical Problems of Energetics (IFTPE)

The average convective heat transfer and the pressure loss of beams from ribbed pipes, including bimetallic pipes, were studied over a wide interval of operating conditions and design parameters in a cross flow of fluid ($Re=2 \times 10^3-3 \times 10^5$, $Pr=0.7-4.4 \times 10^3$, $h/d=0.7-0.33$).

The empirical coefficients of the mathematical model of the mixing of water in Lake Drukshyaya--the cooler of the Ignalinskaya AES--were determined and the prediction of its heat regime was specified.

A new criterion of crack resistance was proposed for refractories of various structures. The possibility of predicting the level of crack resistance of refractories according to the type of their structure was shown. An original method of determining the heat resistance of a broad class of refractories, which consists in the use of a bending load with a reserve of elastic energy, was developed. Equipment was developed for the implementation of the method.

A technology of obtaining removable polymer films was developed. The films have the adhesive strength which is necessary for the protection of power equipment against corrosive substances and radioactive contamination.

A new method of numerical differentiation for the processing of experimental data and algorithms of the identification of parabolic and hyperbolic

distributed systems were developed. The properties of models of autoregression fields were studied and algorithms of the estimation of their parameters in accordance with noise-free observations of the final volume were developed.

The Institute of Chemistry and Chemical Technology (IKhKhT)

Principles of the calculation of the "flow density-time" dependence for potentiostatic occlusion and the linear sweep of the potential in systems of labile complexes were developed. It was shown that the effect of the redistribution of complex particles in a diffusive layer leads to significant deviations from analogous characteristics of complex systems, with the exception of reversible processes in systems with a large surplus of ligand.

It was shown that cation additives--stimulants of the coprecipitation of ceramic micropowders and nickel--interact with the cathode and increase the nickel overvoltage, as a result of which the partial fraction of the hydrogen being given off increases and the alkalization of the catholyte layer occurs. The direct dependence between inhibition and the number of nitrogen atoms in the molecule of the additive was established.

The correlation between the nature of the carbonyl compound and its luster-forming effect was found.

The basic laws of the electrolytic precipitation of zinc and cadmium from cyanide solutions were identified.

The existence of a correlation between the overall speed of the dissolution of monocrystalline zinc and the acidity of the layer near the surface of a solution of hexavalent chrome, which is determined by its anionic composition, was established for the first time.

A new convenient method of synthesizing N-heterocyclic amidoacetals was developed.

The Institute of Biochemistry (IBkh)

It was shown for the first time by the method of the immunochemical interaction of antibodies tagged with ^{125}I with antigen material that iranscortin (a corticosteriod which bonds globulin) is synthesized on membrane-connected polyribosomes of the liver of mice.

The capacity of Fc receptors of the lymphocytes of the blood of cattle to bond the homologous immunoglobulins IgG_1 and IgG_2 was established. The bonding power of the Fc receptors of normal and leukemic lymphocytes is different. It was established that the content of circulating immune complexes in the blood serum of cattle that are ill with leucosis at the advanced stage of leucosis is reduced and that the immune complexes contain the immunoglobulins IgG and IgM.

The kinetic laws of the oxidation-reduction reactions of a number of flavin enzymes, which contain heme and copper, were studied.

The functioning in the mitochondria of the liver of the intermembrane transfer of electrons, in which cytochrome "c" performs the role of the bonding unit, was demonstrated.

A preparative method of synthesizing p-fluorphenylalanine and a number of its N-acyl derivatives, which contain cytotoxic groups, was developed. The transformations of derivatives of alkylthioclorcarboxylic acids under the action of bases were studied, the mechanism of these reactions was shown. Among the synthesized compounds there were found ones which have a pronounced antitumor-antileukemic or growth-stimulating activity.

The Institute of Botany (IB)

The occurrence, ecological biological peculiarities, as well as the reserves of 180 species of the most important fodder, berry, medicinal, and technical plants in the natural cenoses of southern, southeastern, and eastern Lithuania were established. Diagrammatic maps of their overgrowths and cenoses were drawn up, recommendations on their efficient use were formulated. Material from more than 1,000 sites of growths in different biotopes and cenoses was gathered.

The variability of the radial growth of trees and its connection with climatic factors, atmospheric circulation, and solar activity in a number of regions of the USSR was studied by dendroclimatochronological methods.

The threshold of the sensitivity of gravitational force in plants was established for the first time on earth and under the conditions of weightlessness.

During the study of growth processes new derivatives of indolyl acetic acid in cells were isolated and established, their dependence on the peculiarities of phytohormones was established.

In all 18 new derivatives for the regulation of the growth of the stems of barley and wheat were developed. Compounds, which stimulate the formation of the tubers of potatoes and increase their yield on the average by 50 quintals per hectare, were developed.

The Institute of Zoology and Parasitology (IZP)

A law, which explains the mechanism and nature of the structure of models of the dependence of migrations of birds on flying conditions, was established. The causes of reverse migrations were identified and models of these migrations were developed.

When studying the regulation of the behavior of animals the connection of the intensity of the behavioral reaction of fear with a change of biochemical processes of the brain was established.

The correlation dependence between the productivity of the bee colony and the quantity of several components of pheromone of the queen bee was established. Substances, which decompose the pheromone of the queen bee, were ascertained and their localization were determined.

An evaluation of an entomological complex (258 species) of garden pests was made.

New data on the ecological, genetic, and immunogenetic features of the interaction of populations of hosts and their parasites were obtained.

The dependence of gene and allele frequencies and the qualitative and quantitative structures of zoocenoses on the capacity of the heat zones of bodies of water and their stability was established. A qualitative heuristic model of adaptive reorganizations of aqueous cenoses (on the basis of the example of the Ignalinskaya AES) was developed.

The connection between the frequencies of phenotypes in populations of river fish and biotopic features was studies. The biologically active levels of chemical substances of anthropogenic origin, which occur in bodies of water and affect migrating anadromous fish, were determined.

A new conception of the mechanism of the anodic electrotaxis of fish was developed. An evaluation of the smoothness of the work of the heart of fish of different ecological groups in the presence of various environmental stimuli was made on the basis of automated systems.

The Department of Geography (OG) of the Institute of Zoology and Parasitology

The monograph "Bio- i litostratigrafiya pozdnechetvertichnykh donnykh otlozheniy Baltiyskogo morya" [The Bio- and Lithostratigraphy of the Late Quaternary Bottom Sedimentations of the Baltic Sea] (in Russian), in which the well-founded litho- and biostratigraphic subdivision of the sedimentary rock mass and a regional stratigraphic diagram of the bottom sedimentations of the Baltic Sea were presented for the first time, was prepared jointly with scientists of the GDR and Poland.

The Institute of Economics (IE)

A long-term comprehensive program of the development of the united transportation system of the Lithuanian SSR to 2000, which will service for guidance when drafting the five-year plans of the development of transportation, was formulated.

An analysis of the efficiency of the procedure of forming and using the wage fund and the effectiveness of the use at associations and enterprises of the system of material stimulation, the efficiency of the use of economic standards, the methods of stimulating work on the acceleration of the introduction in production of the achievements of science and technology was made.

The first stage on the formulation of the Comprehensive Program of Scientific and Technical Progress of the Lithuanian SSR for 1991-2010 was completed.

The practice of using computers for the performance of various functions of the management of an industrial enterprise was studied and evaluated economically.

The Institute of Philosophy, Sociology, and Law (IFSP)

During the study of the laws of the development of the social activeness of workers and engineering and technical personnel of industrial enterprises the objective production technological and social conditions of social activeness, the subjective factors of its manifestation, and the mechanism of the systematic influencing of the convergence of workers and engineering and technical personnel were revealed. Specific recommendations on the effective formation of the social activeness of workers and engineering and technical personnel were presented. The material was generalized jointly with the Institute of Sociological Studies of the USSR Academy of Sciences in the prepared book "Pokazateli i indikatory sotsialnogo razvitiya rabochego klassa i inzhenerno-tekhnicheskoy intelligentsii Litovskoy SSR" [The Indices and Indicators of the Social Development of the Working Class and the Engineering and Technical Intelligentsia of the Lithuanian SSR] (1984, 380 pages).

The methodological principles of the use of the information of the budget of time in socioeconomic planning at various levels of management--at the level of the country, the republic, the region--were studied.

The structure and dynamics of offenses in the city of Kapsukas were studied, the social factors of offenses were identified, the role of state and economic organs and organs of justice in the planning of preventive measures was studied.

The Institute of History (II)

Works, in which the reactionary activity of the Catholic church in the political and social life of Lithuania during the period of feudalism is analyzed, were prepared for publication.

The collection of documents "Bully rimskikh pap" [The Bulls of the Popes], which reveals the role of the papacy in the organization of aggressive crusades against Lithuania in the 13th-14th centuries, was prepared for publication.

The political system in Lithuania during 1926-1940 was studied, the social policy of the fascist regime was exposed, the political struggle among bourgeois parties and groups was covered.

The Institute of the Lithuanian Language and Literature (ILYaL)

Volume 2 of "Slovar sovremennykh litovskikh familiy" [A Dictionary of Contemporary Lithuanian Surnames], in which contemporary Lithuanian surnames

are presented and their occurrence, frequency, and origin are indicated, was prepared for publication.

The sections of the all-union publication "Istoriya vsemirnoy literatury. Istoriya literatur narodov SSSR dooktyabrskogo perioda" [The History of World Literature. The History of the Literatures of the Peoples of the USSR of the Pre-October Period] on Lithuanian literature of the 18th century, the first and second halves of the 19th century, and the early 20th century were prepared for publication.

The Central Library (TsB)

The holdings of the Central Library were supplemented with 69,815 printed items and at the end of the year came to about 3,445,000 units, including 2,881,835 units in the basic holdings.

International book exchange was conducted with 751 organizations of 40 countries, 11,268 printed units of foreign publications were received.

In all 627 exhibitions of new acquisitions, 31 thematic exhibitions, a exhibition of the scientific book of Bulgaria, and an exhibition of publications of the firm Springer Verlag (West Berlin) were organized. Scientific publications of the Lithuanian SSR were exhibited at exhibitions in Poland and Bulgaria.

Two bibliographic indices (53.47 printer's sheets) were published, the publication of the two-series (alphabetical and systematic) consolidated catalogue "Zarubezhnyye knigi v bibliotekakh Litovskoy SSR" [Foreign Books in he Libraries of the Lithuanian SSR] was continued.

Publishing Activity. In 1984, 164 publications (the total size of which is 1,777 publisher's signatures), including 53 issues of periodicals (566 signatures), 58 books (822 signatures), and 53 thesis, procedural, instructional, information, and other publications (389 signatures), were published with the signature stamp of the Academy of Sciences.

The institutions of the Physical, Technical, and Mathematical Sciences Department published 43 publications (370 signatures), the Chemical, Technological, and Biological Sciences Department--24 (261 signatures), the Social Sciences Department--54 (684 signatures), and the institutions of the Academy of Sciences, which do not belong to departments--43 (462 signatures).

The most important book publications are:

--the Institute of Physics--"Lokalnyye i globalnyye primesi v atmosfere" [Local and Global Contaminants in the Atmosphere] (FIZIKA ATMOSFERY, No 9), "Tochnyye izmereniya v yadernoy spektroskopii" [Exact Measurements in Nuclear Spectroscopy]; the Institute of Semiconductor Physics--S. Ashmontas, "Elektrogradiyentnyye yavleniya v poluprovodnikakh" [Electrogradient Phenomena in Semiconductors] (ELEKTRONY V POLUPROVODNIKAKH, No 5); the Institute of Physical and Technical Problems of Energetics--"Gidrodinamika i vibratsii

obtekayemykh puchkov trub" [The Hydrodynamics and Vibrations of Streamline Tube Banks];

--the Institute of Biochemistry--"Funktsionirovaniye genoma v ontogeneze" [The Functioning of the Genome in Ontogeny], V. Kaluyna and P. Sadauskas, "Tsitomorfologiya opukholey kur" [The Cytomorphology of Tumors of Chickens]; the Institute of Botany--S. Stanyavichene, "Peronosporovyye griby Pribaltiki" [Peronosporales of the Baltic Region], A. Minkyavichyus, "Opredelitel rzhavchinnykh grib Litovskoy SSR" [An Index of Rust Fungi of the Lithuanian SSR]; the Institute of Zoology and Parasitology--"Funktsionirovaniye populyatsiy soobshchestv vodnykh zhivotnykh v vodokhranilishche-okhladitele Litovskoy GRES" [The Functioning of Populations of Communities of Aquatic Animals in the Reservoir-Cooler of the Litovskaya GRES] (TEPLOENERGETIKA I OKRUZHAUYSHCHAYA SREDA, No 4), "Podust"; the Department of Geography of the Institute of Zoology and Parasitology--"Paleogeografiya i stratigrafiya chetvertichnogo perioda Pribaltiki i sopredelnykh rayonov" [The Paleogeography and Stratigraphy of the Quaternary of the Baltic Region and Adjacent Regions];

--the Institute of Economics--B. Blazhis, "Ekonomicheskaya effektivnost ASU v promyshlennosti" [The Economic Efficiency of Automated Control Systems in Industry], "Aktualnyye problemy effektivnosti kapitalnogo stroitelstva" [Urgent Problems of the Efficiency of Capital Construction], V. Vashkyalaytis, "Ekonomicheskiy mekhanizm tekhnicheskogo progressa" [The Economic Mechanism of Technical Progress]; the Institute of History--"Razvitiye politicheskoy sistemy sovetskogo obshchestva v Litve. 1961-1980" [The Development of the Political System of Soviet Society in Lithuania. 1961-1981]; the Institute of Philosophy, Sociology, and Law--M. Titma and M. Talyunayte, "Prestizh professii" [The Prestige of an Occupation], A. Dyagutis, "Yazyk, myshleniye i deystvitelnost" [Language, Thought, and Reality], "Ucheniye Karla Marksa i sovremennaya ideologicheskaya borba" [The Teachings of Karl Marx and the Present Ideological Struggle]; the Institute of the Lithuanian Language and Literature--volume 13 of the academy "Dictionary of Lithuanian," A. Valyatskene, "Grammaticheskaya sistema litovskogo yazyka" [The Grammatical System of Lithuanian].

Expeditions. In 1984 the institutes of the Academy of Sciences organized 90 field trips, in which more than 650 people took part.

The Institute of Physics. Photographic and photoelectric observations of stars were made on Maydanak Mountain (the Uzbek SSR).

In the environs of the Ignalinskaya AES the concentrations of radionuclides in the layer of air near the earth were measured; equipment was tested and a method of measuring the concentration of short-lived radioactive inert gases was approved.

The gathering of samples of the surface microlayer of water and foam and their primary radiochemical treatment for the subsequent measurement of the concentration of artificial radionuclides were carried out in the surf zone of the Baltic Sea.

The Institute of Physical and Technical Problems of Energetics. Observations of the dynamics of the water balance of Lake Drukshyay, as well as measurements of meteorological elements depending on the distance from the lake were made.

The Institute of Biochemistry. Studies of the leucosis of cattle were conducted at the livestock farms of Kaunasskiy, Alitusskiy, Shyaulyayskiy, Panyavezhskiy, Moletskiy, Shvyanchenskiy, and other rayons of the republic.

The Institute of Botany. Expeditions for the study of flora and vegetation, the ecology of micromycetes, and phytoviruses, the ecological study of the landscape, the study of the northern section of the Kurshyu-Mares Gulf, the study of useful plants and green plantings in rural areas, dendroclimatochronological studies, and others were organized.

The Institute of Zoology and Parasitology. Expeditions were conducted: an expedition on the zoology of dry land, a pedobiological parasitological expedition, an expedition on ecological studies of the region of the Ignalinskaya AES, a hydrobiological expedition.

The Department of Geography. Landscape geochemical studies were conducted, the dynamics and morphology of seacoasts and the pollution of the water and soils of the sea were studied.

The Institute of History. The burial grounds in Kryatingskiy Rayon were studied. Material was collected on the themes: folk weaving, beekeeping in the later 19th and early 20th centuries, ancient means of grinding, the ethnodemographic development of the family of the urban population under the conditions of mature socialism.

The Institute of the Lithuanian Language and Literature. Onomastic and other linguistic material was collected in Birzhayskiy and Panyavezhskiy Rayons. In Lazdiyskiy Rayon 3,000 words were collected for "The Dictionary of Lithuanian." In Anikshchyayskiy Rayon 3,500 folklore works--1,100 songs, 900 tales, 1,400 units of minor genres of folklore--were recorded.

Scientific Conferences. In 1984 the institutes of the Academy of Sciences organized 11 scientific conferences, symposiums, and meetings, of them 8 were all-union and 3 were republic.

The Institute of Mathematics and Cybernetics. The All-Union Symposium "Modern Problems of Mathematical Economics."

The Institute of Physics. The 6th All-Union Conference on the Nonresonance Interaction of Optical Radiation With Matter, which was organized jointly with the Scientific Council of the USSR Academy of Sciences for the Problem "Coherent and Nonlinear Optics," the State Optical Institute imeni S.I. Vavilov, and the Institute of General Physics imeni P.N. Lebedev of the USSR Academy of Sciences. Specialists from 143 organizations of 42 cities took part.

The Institute of Semiconductor Physics. The Conference of Young Scientists "The Physics, Technology, and Production of Semiconductor Instruments."

The Institute of Physical and Technical Problems of Energetics. The All-Union Conference "Directions of the Development of Power Engineering and the Trends of Scientific and Technical Progress in It Under the Conditions of the Northwest of the USSR With Allowance Made for the Energy-Saving Policy." There were 72 participants.

The 6th All-Union School of Young Scientists and Specialists "Nuclear Power Engineering and the Environment." (Footnote 21) (A. Ashmantas, Y.-E. Adomaytis, "The 6th All-Union School of Young Scientists and Specialists in Problems of Neutron Reactors 'Nuclear Power Engineering and the Environment'," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 2 (147), 1985, pp 125-126)

The Institute of Botany. The All-Union Conference "The Theory and Practice of the Use of the Immunity of Agricultural Crops to Viral Diseases."

The Institute of Zoology and Parasitology. The All-Union Conference "Problems of the Protection of the Animal World" and the plenum of the Scientific Council of the USSR Academy of Sciences for the Problem "The Biological Principles of the Development, Improvement, and Protection of the Animal World." There were 101 participants from 35 institutions.

The Department of Geography. The 2d Coordinating Conference of Directors of the Geographical Institutions of the USSR Academy of Sciences and the Academies of Sciences of the Union Republics and the scientific session of the Scientific Council for Problems of the Biosphere attached to the Presidium of the USSR Academy of Sciences "The Geographical Forecast: Theory, Methods, the Regional Aspect." There were 46 participants.

The Institute of Economics. The Republic Conference "Problems of the Regulation of the Movement of Manpower Resources and the Population."

The Institute of History and the Institute of the Lithuanian Language and Literature. The joint conference "Urgent Ideological Esthetic Problems of Lithuanian Soviet Art."

The Central Library. The 18th All-Union Conference "Book Collections: Questions of Acquisition and Preservation."

The Introduction of the Results of Scientific Research. (Footnote 22) (Also see the sources indicated in footnote 16) In 1984 the elaboration of 209 scientific and technical themes was completed, of them 177 were economic contractual themes. In all 125 developments were introduced in the national economy. The total (accumulated over 5 years of introduction) economic impact is 41.8 million rubles, the primary (accumulated during just the 1st year of introduction) impact is 7 million rubles (see Table 4).

The most important results of research, which were introduced or were being introduced in practice in 1984, are cited below.

Table 4. The Economic Impact From the Introduction of the Results of Research, Contracts on Creative Cooperation, Revenues and Expenditures on Economic Contractual Operations, and the Inventing Activity of the Institutes of the Institutes of the Lithuanian SSR Academy of Sciences in 1984

Institute	1	2	3	4 6	5	7	8	9
Institute of Mathematics and Cybernetics	26	5.4	50	1311	1176	20	8	12
Institute of Physics	6	7.3	44	2659	1958	25	10	15
Institute of Semiconductor Physics	15	1.4	31	1865	1759	43	22	26
Institute of Physical and Technical Problems of Energetics	40	6.0	50	2143	1908	20	12	16
Institute of Chemistry and Chemical Technology	22	17.2	30	1646	1163	17	14	11
Institute of Biochemistry	12	0.1	17	122	87	13	8	20
Institute of Botany	8	1.1	36	518	348	9	5	9
Institute of Zoology and Parasitology	4	3.3	37	285	293	3	-	-
Institute of Economics	-	-	40	160	87	-	-	-
Institute of Philosophy, Sociology and Law	-	-	20	76	75	-	-	-
Institute of History	-	-	8	48	36	-	-	-
Institute of the Lithuanian Language and Literature	-	-	5	-	-	-	-	-
Total	133	41.8	368	10833	8890	150	79	109

Key:
1. Works introduced
2. Total (accumulated over 5 years) economic impact (millions of rubles)
3. Contracts on cooperation
4. Revenues
5. Expenditures
6. On economic contractual operations (thousands of rubles)
7. Applications for inventions submitted
8. Positive decisions received
9. Certificates of authorship received

The Institute of Mathematics and Cybernetics. Programs for the solution of multi-extremum problems of designing on the MVK ELBRUS (for the purpose of the optimization of the composition of paints, the parameters of the immunological model, computations when developing devices of vibration displacements) were introduced at nine organizations.

The SORRA (System of the Online Development of Algorithm Recognition) package of applied programs for the identification of noise-type signals, which was improved and supplemented with new modules, was introduced at the Scientific Research Institute of Means of Automation (Minsk).

Jointly with the Institute of Semiconductor Physics algorithms and programs of the optimization of thin-film internal coatings of electron-beams instruments, which will make it possible to improve the quality of picture tubes, were introduced at the Ekranas Plant (Panyavezhis), while a mathematical model of the optimization of integrated circuits was developed for the Nuklon Plant (Shyaulyay).

The Institute of Physics. Highly automated programs for the numerical solution of Hartree-Fock equations with supplementary conditions and the calculation of the energy spectrum of atoms and ions were introduced at Kharkov State University.

A logarithmic spectrometer for the continuous periodic measurement and recording of the aerosol state of the atmosphere was introduced in practice.

A method of affecting cumulonimbus clouds for the purpose of averting hail was introduced in the Moldavian SSR.

Laser equipment and a process of the laser thermal hardening of drills were introduced at the Vilnyus Furniture Plant.

The Institute of Semiconductor Physics. A completely automated unit for the local contactless determination of the mobility and concentration of current carriers and their coordinate distribution in a semiconductor plate was introduced.

There were introduced: a device for the determination of the longitudinal and lateral components of the induction of the magnetic field which focuses charged particles in an accelerator; magnetically sensitive heads for the determination of the quality of products of ferrous metallurgy; the Vilnyale-2 and Vilnyale-3 microcomputers at the Shyaulyay Television Plant.

The Institute of Physical and Technical Problems of Energetics. The results of the study of the conditions of heat transfer for open-hearth furnaces were used at enterprises of Sverdlovsk.

The Shpat-1 spackling compound, which was developed at the institute, is being used at the Kaunas Tsentrolit Plant and the Alitus Machine Building Plant.

A package of programs for the numerical differentiation of measurable thermal values was introduced at the Institute of Technical Thermal Physics of the Ukrainian SSR Academy of Sciences.

Equipment and methods for checking the processes in the reactors of the Ignalinskaya AES were introduced.

The results of research on the optimization of deliveries of petroleum products to enterprises of the Lithuanian SSR were introduced.

The Institute of Chemistry and Chemical Technology. Work on the introduction of the results of scientific research was completed at 20 enterprises (at 19

on an economic contractual basis and at 1 in accordance with a contract on creative cooperation).

In all 22 technological developments were introduced in production, 20 of them are protected by certificates of authorship. Technological processes, which are protected by certificates, were introduced 32 times, but most often the Limeda NBTs alkaline cyanide-free electrolyte, which was introduced at 8 enterprises and provided the largest primary annual economic impact--246,900 rubles.

At the Ufa Plant of Switching Equipment 16 processes, which were developed at the Institute of Chemistry and Chemical Technology, were introduced, of them 11 were introduced in place of technologies of foreign firms.

The largest economic impact from 1 enterprise--1.31 million rubles--was obtained at the Ufa Plant of Switching Equipment. A primary economic impact was obtained at 11 enterprises and for the first time at the Institute of Chemistry and Chemical Technology exceeded 2 million rubles (2,107,000 rubles). The overwhelming portion of it was obtained outside the republic. In the Lithuanian SSR five processes were introduced at enterprises of Kapsukas, Shyaulyay, and Vilnius. The production relations of the institute with enterprises of the Urals, Kazakhstan, and Siberia were broadened.

Two technological developments were introduced for the first time (moreover, significantly ahead of time). These are the technological process of weak acid bright galvanizing from the Limeda OTs nonfoaming electrolyte and a sulfuric acid electrolyte for the electroplating of the holes of printed circuit boards.

The Institute of Biochemistry. Laboratory models of the Enzalist-G proximate analyzer for the rapid determination of glucose in blood and other biological fluids were developed and produced in the Experimental Production Section. The high selectivity of the analyzer is ensured by a multilayer system of membranes. The analyzer is being used at clinics, for the mass examination of the population, and in the microbiological and food industries. The technical specifications for the series production of analyzers are being prepared.

A serological method of the early diagnosis of leucosis of cattle was used at the Republic Veterinary Laboratory (the primary annual economic impact is 85,600 rubles).

The Institute of Botany. The most important introduced works are: the recommendation "Norms of Mineral Fertilizers for Sugar Beets in Case of the Application of Manure and on Various Predecessors" (the primary impact is 73,400 rubles); a unit for the growing of chlorella (the Shirvinta Kolkhoz); a live indicator for the monitoring of the toxicity of fodders (the Giryals Poultry Plant); the evaluation of the properties and the certification of polymer materials for microbiological resistance and atmospheric aging under natural conditions; the Fiton-3 instrument for the conducting of experiments with plants under weightless conditions.

The Institute of Zoology and Parasitology. Recommendations on the biotechnology of raising producers and using the breeding schools of herbivorous fish were introduced at enterprises of the Administration of the Fish Industry (the primary impact is 85,400 rubles); the results of the studies made by the Department of Geography of the peculiarities of the dynamics and direction of the development of the coastal zone of the Kurshskiy Sand Bar from the side of the bay for the purpose of formulating shore-protection measures on the sections being eroded were introduced in Kaliningrad Oblast (the economic impact is 500,000 rubles).

The Institute of Economics. There were turned over for introduction: proposals on the improvement of the economic evaluation of the use of computers; proposals on the development of the united transportation system of the Lithuanian SSR; the basic provisions of the procedural recommendations of regional forecasting (at the level of the union republic); an evaluation of the demographic situation in the Lithuanian SSR; a forecast of the basic indicators of the Lithuanian SSR national economy to 2010, and others.

The Institute of Philosophy, Sociology, and Law. The results of research: on the peculiarities of collaboration between bourgeois nationalism and Catholic clericalism, on the improvement of preventive educational work among minors, on the prospects of the studies of the problems of the communist education of young people for 1986-1990 and of the indices and indicators of the social development of the working class and engineering and technical personnel, were turned over for introduction.

Patent and License Work. (Footnote 23) (Also see the sources indicated in footnote 16) In 1984 the institutes of the Academy of Sciences submitted 150 applications for inventions and received 109 certificates of authorship and 79 positive decisions (see Table 4).

In all 168 efficiency proposals, of which 157 were used in practice, were submitted.

A total of 71 scientific, technical, and experimental design developments, which are protected by certificates of authorship, were used in the national economy.

In all 10 applications were submitted for the registration of trademarks and production prototypes, 2 trademarks were registered. Two works were patented abroad.

More than 150 inventions were exhibited at republic, all-union, and international exhibitions. A electrolyte of silver-mat nickel plating (the Institute of Chemistry and Chemical Technology) was presented at exhibitions: the Leipzig Trade Fair, the Soviet Inventions Exhibition (Berlin), and the Soviet Chemistry Exhibition (Belgrade).

In all 20 competitions were held for inventors of the institutes of the Academy of Sciences. A total of 294 scientists, including 21 doctors of sciences and 184 candidates of sciences, took part in the development of

inventions. In all 28 people, 12 of who are graduates of the central institute for the increase of patent skills, worked in the patent services of the Academy of Sciences. The primary organizations of the All-Union Society of Inventors and Efficiency Experts united more than 280 members.

Contracts on Creative Cooperation (see Table 5). In 1984 the institutes of the Academy of Sciences had 368 contracts on socialist scientific and technical creative cooperation (154 with organizations located on the territory of the Lithuanian SSR and 214 with organizations of other union republics). The Institute of Mathematics and Cybernetics (50), the Institute of Physical and Technical Problems of Energetics (50), the Institute of Physics (44), and the Institute of Economics (40) had the largest number of contracts. In all 83 contracts with production organizations were being fulfilled.

Table 5. Contracts on Socialist Scientific and Technical Creative Cooperation of the Institutions of the Academy of Sciences in 1982-1984

Institute	Number of contracts by year		
	1982	1983	1984
Institute of Mathematics and Cybernetics	49	45	50
Institute of Physics	38	39	44
Institute of Semiconductor Physics	20	26	31
Institute of Physical and Technical Problems of Energetics	36	41	50
Institute of Chemistry and Chemical Technology	39	30	30
Institute of Biochemistry	15	16	17
Institute of Botany	64	49	36
Institute of Zoology and Parasitology	29	32	37
Institute of Economics	15	14	40
Institute of History	8	9	8
Institute of Philosophy, Sociology, and Law	19	19	20
Institute of the Lithuanian Language and Literature	5	5	5
Total	337	325	368

Especially close cooperation was carried out with the USSR Academy of Sciences (41 contracts), organizations of the Belorussian SSR (Footnote 24) (See: Y. Samaytis and T. Sidorenko, "The Joint Expanded Meeting of the Presidiums of the Belorussian SSR and Lithuanian SSR Academies of Sciences (11 February 1981)," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 2 (129), 1982, pp 95-99) (20), the city of Shyaulyay (Footnote 25) (See: Y. Samaytis, V. Ulyavichyus, and V. Petrauskas, "The Prospects of Comprehensive Scientific and Technical Cooperation Between the Academy of Sciences and the City of Shyaulyay," TRUDY AKADEMII NAUK LITOVSKOY SSR. SERIYA B, Vol 2 (141), 1984, pp 106-112) (15 contracts, 46 themes were being fulfilled, of them 37 were completed), and Vilnius State University (19).

International Scientific Relations. In all 99 associates of the Academy of Sciences went abroad, 14 of them for the performance of science research and 40 for participation in conferences. Reports were delivered abroad by: P. Bluzma (Sweden), R. Brazis (Japan), A. Vanagas (the GDR), corresponding member B. Grigyalenis (France), and academician Yu. Pozhela (the United States).

At the session of the Council of the Society of Physicists of Europe, which was held in Switzerland, Academician Yu. Pozhela was elected a member of this society.

The Academy of Sciences admitted 118 foreign members.

The Institute of Mathematics and Cybernetics jointly with academic institutes of Hungary, the GDR, Romania, and the CSSR studied the problem "Probability Theory and Mathematical Statistics."

The Institute of Physics jointly with the Institute of Solid-State Physics and the Institute of Nuclear Research and Nuclear Energy of the Bulgarian Academy of Sciences worked on problems of the theory of the atomic nucleus.

The Institute of Physical and Technical Problems of Energetics performed joint research with the B. Kidric Institute of Nuclear Sciences (Yugoslavia) and concluded a contract on the performance of joint research with the Institute of Thermomechanics of the Czechoslovak Academy of Sciences.

The Institute of Chemistry and Chemical Technology continued joint research on the problem "The Protection of Metals Against Corrosion" with 12 organizations of Hungary, the GDR, Bulgaria, Poland, Romania, and the CSSR.

Activity on the Popularization of Science. The academywide organization of the Society for Knowledge on 31 December 1984 united 783 members. In all 3,525 lectures were delivered for the public of the republic, 771 popular science articles were published in the republic press, and 443 appearances were made on television and radio. In all 36 group trips to cities and rayons of the republic were organized, of them 10 were combined "Days of Science" (1 such measure was implemented in Panyavezhis, where 15 years ago "Days of Science" were organized for the first time in the republic on the initiative of the academywide organization of the Society for Knowledge).

Cooperation with the Shyaulyay City and Moletskiy Rayon Organizations of the Society for Knowledge was continued, cooperation with the organization of the Society for Knowledge of the city of Snechkus was begun.

Faculties of the Republic People's University continued work at the base of institutes of the Academy of Sciences: at the Institute of Mathematics and Cybernetics--the Faculty of the Application of Mathematics and Computer Technology, at the Institute of Chemistry and Chemical Technology--the Faculty of Electroplating Knowledge, at the Institute of the Lithuanian Language and Literature--the Literature Faculty.

The Republic Correspondence School of the Young Programmer continued work at the Institute of Mathematics and Cybernetics, the School of Young Biochemists continued work at the Institute of Biochemistry.

Many tourist groups visited the institutes of the Academy of Sciences and their subdivisions.

Socialist Competition. The collective of the Academy of Sciences fulfilled and exceeded all the academy-wide socialist obligations. The planned scientific research work was completed by 31 December 1984, economic contractual operations in the about of 10,845,000 rubles were performed, 150 applications for inventions were submitted, 11 doctoral dissertations and 62 candidate dissertations were submitted for defense, manuscripts of 90 scientific works were sent to the press, about 33,000 hours were worked on communist Saturdays, the total economic impact from the introduction of the results of scientific research came to 41.8 million rubles.

The Institute of Physics, the Institute of Botany, and the Institute of History were the winners of the interinstitute socialist competition.

The following subdivisions were the winners of the competition at the institutes and institutions:

--the Institute of Mathematics and Cybernetics--the Department of Optimum Solutions (the director is Academician Y. Motskus), the Institute of Physics--the Department of Laser Optoelectronics (Academician Yu. Vishchakas), the Institute of Semiconductor Physics--the Sector of High Frequency Instabilities (V. Ryaklaytis), the Institute of Physical and Technical Problems of Energetics--the Laboratory of Physical Chemical Processes of Heat Transfer (V. Makaryavichyus),

--the Institute of Chemistry and Chemical Technology--the Laboratory of Zinc and Cadmium Plating (Yu. Shivitskis), the Institute of Biochemistry--the Laboratory of Enzyme Chemistry (Yu. Kulis), the Institute of Botany--the Laboratory of the Study of Biodegraders (A. Lugauskas), the Institute of Zoology and Parasitology--the Laboratory of Ornithology (M. Zhalakyavichyus), the Department of Geography of the Institute of Zoology and Parasitology--the Laboratory of Landscape Geomorphology and Geochemistry (G. Paulyukyavichyus),

--the Institute of Economics--the Department of Political Economy (Academician A. Burachas), the Institute of History--the Department of the History of Feudalism (M. Yuchas), the Institute of Philosophy, Sociology, and Law--the Department of Problems of the Socialist Way of Life (A. Mitrikas), the Institute of the Lithuanian Language and Literature--the Department of Dictionaries (Corresponding Member K. Ulvidas), the Central Library--the Department of Manuscripts (E. Treynene).

Creative cooperation of the Academy of Sciences with the Belorussian SSR Academy of Sciences (Footnote 26) (See the sources indicated in footnote 24)

and comprehensive scientific and technical cooperation with the city of Shyaulyay (Footnote 27) (See the sources indicated in footnote 25) were continued.

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CSO: 1814/99

BREAKDOWN OF SCIENTISTS BY DEGREES, TITLES

Moscow VESTNIK STATISTIKI in Russian No 12, Dec 85 pp 69-72

[Table]

[Text] I. The Number and Composition of Scientists by Academic Degrees and Academic Titles (at the end of the year; people)

	1960	1970	1975	1980	1984
USSR					
Number of scientists.....	354158	927709	1223428	1373263	1463806
of them those who have the academic degree of:					
doctor of sciences.....	10945	23616	32264	37747	42748
candidate of sciences.....	98262	224490	326767	296244	449868
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	9907	18095	22942	27381	30308
docent.....	36155	68581	87884	110698	128581
senior scientific associate...	20259	39005	53323	65951	75430
junior scientific associate and assistant lecturer.....	26693	48849	44978	41101	40783
RSFSR					
Number of scientists.....	242872	631111	838473	937665	1002815
of them those who have the academic degree of:					
doctor of sciences.....	7929	16135	22105	25838	29150
candidate of sciences.....	67146	145071	212363	257329	290701

	1960	1970	1975	1980	1984
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	6784	11859	15146	17885	19741
docent.....	23610	42926	53783	66902	76588
senior scientific associate...	14202	25184	34574	44012	50346
junior scientific associate and assistant lecturer.....	17783	32141	30367	29423	28934
Ukrainian SSR					
Number of scientists.....	46657	129781	171478	195782	204877
of them those who have the academic degree of:					
doctor of sciences.....	1343	3123	4163	4842	5595
candidate of sciences.....	13622	33317	47308	58002	66422
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	1308	2590	3211	3818	4234
docent.....	5892	12079	15106	19221	22455
senior scientific associate...	2290	5085	6850	8395	9868
junior scientific associate and assistant lecturer.....	1731	3516	2266	1880	3644
Belorussian SSR					
Number of scientists.....	6480	21863	31020	38130	40198
of them those who have the academic degree of:					
doctor of sciences.....	181	425	624	779	962
candidate of sciences.....	2013	5564	8362	10820	12669
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	185	382	485	657	772
docent.....	855	1962	2724	3679	4581
senior scientific associate...	369	855	1278	1709	2035
junior scientific associate and assistant lecturer.....	718	1036	1001	1273	1017

	1960	1970	1975	1980	1984
Uzbek SSR					
Number of scientists.....	10329	25244	30835	35288	37855
of them those who have the academic degree of:					
doctor of sciences.....	222	494	745	939	1172
candidate of sciences.....	2442	6907	10505	12992	15221
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	241	423	560	764	926
docent.....	1021	2126	2958	3941	5078
senior scientific associate...	431	956	1291	1509	1788
junior scientific associate and assistant lecturer.....	687	890	1255	1593	1261
Kazakh SSR					
Number of scientists.....	9623	26802	32011	37390	39769
of them those who have the academic degree of:					
doctor of sciences.....	157	421	607	708	835
candidate of sciences.....	2123	6272	9642	11621	13377
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	178	340	468	557	642
docent.....	793	2009	2844	3769	4443
senior scientific associate...	566	1097	1655	1776	1949
junior scientific associate and assistant lecturer.....	1530	1646	1646	772	657
Georgian SSR					
Number of scientists.....	9137	20160	24941	25198	26854
of them those who have the academic degree of:					
doctor of sciences.....	430	989	1228	1335	1362
candidate of sciences.....	3207	5860	7679	9104	10146
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	392	814	911	1045	1020
docent.....	1195	1698	2183	2696	3007

	1960	1970	1975	1980	1984
senior scientific associate...	739	1752	1912	2019	2121
junior scientific associate and assistant lecturer.....	1184	3084	1608	616	692
Azerbaijan SSR					
Number of scientists.....	7226	17082	21280	21993	23305
of them those who have the academic degree of:					
doctor of sciences.....	189	652	811	907	952
candidate of sciences.....	1983	5346	7196	8186	9153
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	204	506	623	708	743
docent.....	743	1141	1862	2174	2565
senior scientific associate...	474	1197	1523	1515	1782
junior scientific associate and assistant lecturer.....	682	2042	3145	2323	2381
Lithuanian SSR					
Number of scientists.....	3320	8978	12538	14307	14558
of them those who have the academic degree of:					
doctor of sciences.....	31	182	274	347	457
candidate of sciences.....	758	2710	4339	5197	5820
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	72	165	231	331	412
docent.....	285	923	1348	1841	2167
senior scientific associate...	87	389	676	864	995
junior scientific associate and assistant lecturer.....	227	362	83	32	63
Moldavian SSR					
Number of scientists.....	1999	5695	7309	8807	9710
of them those who have the academic degree of:					
doctor of sciences.....	48	113	192	241	298
candidate of sciences.....	564	1834	2882	3506	4112

	1960	1970	1975	1980	1984
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	39	97	142	183	211
docent.....	198	519	699	922	1146
senior scientific associate...	133	284	435	524	623
junior scientific associate and assistant lecturer.....	196	589	668	76	61
Latvian SSR					
Number of scientists.....	3348	8895	12024	12585	13448
of them those who have the academic degree of:					
doctor of sciences.....	64	175	262	332	379
candidate of sciences.....	898	2517	3484	4172	4620
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	97	165	200	250	287
docent.....	346	719	1052	1320	1483
senior scientific associate...	177	387	543	669	739
junior scientific associate and assistant lecturer.....	295	650	565	662	674
Kirghiz SSR					
Number of scientists.....	2315	5867	7131	8194	8879
of them those who have the academic degree of:					
doctor of sciences.....	56	128	172	198	216
candidate of sciences.....	587	1572	2214	2588	2995
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	64	114	132	170	190
docent.....	197	412	545	684	785
senior scientific associate...	110	309	462	469	521
junior scientific associate and assistant lecturer.....	172	37	31	18	2

	1960	1970	1975	1980	1984
Tajik SSR					
Number of scientists.....	2154	5067	6629	7590	8328
of them those who have the academic degree of:					
doctor of sciences.....	33	102	149	183	216
candidate of sciences.....	433	1364	2126	2505	2963
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	40	90	120	147	169
docent.....	150	358	571	785	957
senior scientific associate...	111	204	335	409	446
junior scientific associate and assistant lecturer.....	298	1131	510	417	233
Armenian SSR					
Number of scientists.....	4275	12808	17138	19059	20897
of them those who have the academic degree of:					
doctor of sciences.....	164	482	630	700	715
candidate of sciences.....	1502	3346	4734	5624	6512
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	161	370	479	540	594
docent.....	562	1006	1268	1566	1928
senior scientific associate...	364	821	1091	1262	1271
junior scientific associate and assistant lecturer.....	520	1176	1424	1642	756
Turkmen SSR					
Number of scientists.....	1836	3649	4634	5030	5462
of them those who have the academic degree of:					
doctor of sciences.....	32	62	92	108	133
candidate of sciences.....	361	1200	1714	1998	2267
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	52	54	62	84	102
docent.....	102	239	331	437	515

	1960	1970	1975	1980	1984
senior scientific associate...	77	186	261	308	370
junior scientific associate and assistant lecturer.....	329	13	1	-	24
Estonian SSR					
Number of scientists.....	2227	4707	5987	6245	6851
of them those who have the academic degree of:					
doctor of sciences.....	66	133	210	290	306
candidate of sciences.....	623	1610	2219	2600	2890
Of the total number of scientists those who have the academic title of:					
academician, corresponding member, professor.....	90	126	172	242	265
docent.....	206	464	610	761	883
senior scientific associate...	129	299	437	511	576
junior scientific associate and assistant lecturer.....	341	536	408	374	384

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CSO: 1814/95

ROLE OF ROBOTICS IN SOLVING PRODUCTION, SOCIAL PROBLEMS

Moscow PRIRODA in Russian No 12, Dec 85 pp 1-10

[Article by corresponding member of the USSR Academy of Sciences, doctor of technical sciences, Professor Yevgeniy Pavlovich Popov: "Robots and Information Science"; first paragraph is PRIRODA introduction]

[Text] Yevgeniy Pavlovich Popov, corresponding member of the USSR Academy of sciences, doctor of technical sciences, professor. Chief of the Robotic Systems Chair of the Moscow Higher Technical School imeni N.E. Bauman, director of the Robotics Scientific Educational Center of the USSR Academy of Sciences and the USSR Ministry of Higher and Secondary Specialized Education, chairman of a section of the scientific and technical council for robotics and flexible production systems of the same ministry, deputy chairman of the Scientific Council of the USSR Academy of Sciences for the same problem, chairman of the scientific methods council of the USSR Ministry of Higher and Secondary Specialized Education for education in the field of robotics. His basic sphere of scientific activity is automated control and robotics. Author of a number of monographs on these questions, including: "Prikladnaya teoriya nelineynykh avtomaticheskikh sistem" [The Applied Theory of Nonlinear Automatic Systems], Moscow, 1973; "Teoriya lineynykh sistem avtomaticheskogo upravleniya" [The Theory of Linear Systems of Automatic Control], Moscow, 1978; "Teoriya nelineynykh sistem avtomaticheskogo upravleniya" [The Theory of Nonlinear Systems of Automatic Control], Moscow, 1979; "Manipulyatsionnyye roboty. Dinamika i algoritmy" [Manipulation Robots. Dynamics and Algorithms] (in collaboration with A.F. Vereshchagin and S.L. Zenkevich), Moscow, 1978. USSR State Prize winner.

At the April and October (1985) CPSU Central Committee Plenums and the June (1985) conference in the CPSU Central Committee on questions of the acceleration of scientific and technical progress the task of the fundamental intensification of the national economy and the significant increase of the output of products at existing industrial enterprises with the same and even a smaller number of workers was posed. This is possible only in case of the retooling of enterprises on the basis of the complete automation of technological processes with the sharp decrease of the proportion of manual labor.

Practical experience has shown that in many cases it is impossible to mechanize manual labor at the works by using traditional means of automation. In other words, the automatic machine should carry out movements which are reminiscent of the movements of human hands. Therefore, in our times the vital need has arisen for the development and extensive use of industrial robots, the basic actuating device of which is the manipulator, that is, a multiple-unit mechanism with controllable drives in all the joints of the units. Owing to the advanced automatic system of the control of the robot, its manipulator carries out actions which are similar to the actions of man in the process of labor activity.

At the mentioned conference in the CPSU Central Committee particular attention was directed to the need for the development of flexible production systems, which are easily readjusted in case of a change of the product and the introduction of a new technology and are attended by a much smaller number of people than the ones which exist now. Precisely the robot, which is united with a computer, is a machine of the new type, the control system of which is distinguished by easy conversion to the most diverse types of "manual" operations. Thus, the computer-controlled industrial robot should become one of the basic components of flexible machine systems in plant shops, in mines, under water, and so on.

It is customary to divide robotic systems into the following classes: manipulation, mobile, as well as information and control.

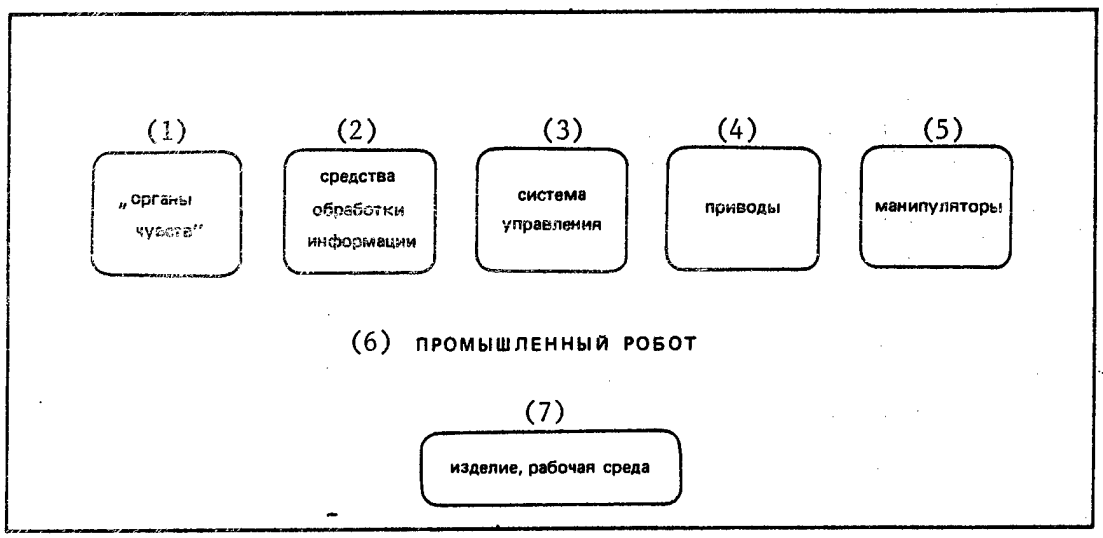
The mobile systems contain a platform (chassis), the movement of which is controlled by an automatic machine in accordance with a program, which sets the route of movement and the address of the goal and ensures automatic loading and unloading. In production shops special cars for the automatic delivery of blanks and tools to the machine tools and of the machined parts from the machine tools to the warehouses perform this role. In various practical spheres the mobile robotic systems are not only wheeled, but also caterpillar, walking, floating, flying, and so forth.

The information and control systems are sets of measuring, information, and control equipment, which carry out automatically the gathering, processing, and transmission of information, as well as use it for the formation of various control signals. In industrial shops these are, for example, systems of the automatic monitoring and control of production processes, under underwater conditions--floating unmanned apparatus, which is equipped with measuring instruments, control devices and automatic movie and photographic equipment, which have been adapted for the determination of the properties of water and the bottom, for the search for, detection, and recognition of some objects or others, as well as for the automatic processing and output of information.

The manipulation systems, in turn, are divided into automatic systems, remote-controlled systems, and systems which are directly connected with the movement of the hands (and at times also the feet) of man. The first type of manipulation robots, of course, is of the greatest interest. They are used primarily in industry, while the remote-controlled systems are used mainly under extreme conditions (in case of increased radiation, gas contamination,

explosion hazard, high or low temperatures and pressures). The third type is intended mainly for loading, unloading, and other especially difficult operations.

Functional Diagram of the Industrial Robot. The actions of the robot, which performs a specific technological operation (the delivery of blanks to the machine tool or under the press, the welding or assembly of parts, and so forth), are synchronized with the operation of the corresponding equipment, which constitutes a part of the work environment, with which the robot has to interact. The "sense organs" of the robot are various sensors, which react to some characteristics or others of the work environment. The data from the sensors, which have been converted by the information processing equipment, are fed to the control system, which generates the signals of the control of the drives, which, in turn, actuate the manipulators which act on the item.



Key:

1. "Sense organs"
2. Information processing equipment
3. Control system
4. Drives
5. Manipulators
6. Industrial robot
7. Item, work environment

Three generations (families) of automatic manipulation robots exist: programmed, adaptive, and "intelligent."

Programmed robots (first-generation robots) have controllable drives in all the "joints" of the manipulator, while their control system is easily readjusted from one operation to another. But after each readjustment they repeat many times the same rigid program in a strictly given situation with objects

which have been arranged in a specific way. Such are the majority of modern industrial robots, which perform various auxiliary operations at machine tools, presses, punches, casting machines, and so on.

The second generation--adaptive robots--can independently (to a greater or smaller degree) get their bearings in a not strictly defined situation and operate by adapting (adjusting) to it. For this they are equipped, first, with special sensors which react to the situation (kinds of "sense organs") and, second, with a system for the processing of the information, which is received from these sensors, and the formation of signals of adaptive control, that is, the flexible change of the program of the manipulators in conformity with the actual situation. Various microprocessor devices are used extensively in such systems.

Adaptive robots are irreplaceable in all instances, when it is difficult to create a strictly fixed situation--in case of the need to avoid various obstacles, in work with parts moving on a conveyor, in assembly, welding, and other operations. Individual versions of such robots have already been developed and are being used in production.

"Intelligent" robots are the result of the further development of adaptive systems and are equipped with significantly more diverse "sense organs" and microprocessor information processing systems, can recognize a situation and automatically make decisions on their subsequent actions for the fulfillment of the necessary operations in an uncertain situation or a situation which is changing in a complex manner, in other words, have components of artificial intelligence.

Each generation consists of robots of various types. They can be distinguished by the principles of construction and the design of the control devices and drives in the "joints" of the manipulators, by the number of their units, by the load-carrying capacity, by the type of "sensitization," by the software, and so forth.

The robot is most effective as a component of a completely mechanized production line. In contrast to man it can be arranged arbitrarily with respect to the production equipment on the floor, the wall, a suspension device, or even directly on the machine tool. Therefore, there is no need to adjust the production equipment for robotized production to the level of the eyes or hands of man--they arrange it in the most convenient way (without high frames, with any layout horizontally and vertically).

The extensive use of industrial robots is of enormous economic importance.

First, the multifunctionality and easy readjustment of robotic systems make it possible to decrease sharply the time and the expenditures on the improvement and changeover of production and on the assimilation of new technologies and items and create favorable conditions for the automation of small-series and multiproduct production.

Second, as experience shows, the use of several robots, which are linked with a computer, in production lines increases their productivity on the average by

two- to fourfold (and at times by six- to eightfold) as compared with a single "robot--machine tool" system which is included in an ordinary production line.

Further, a significant saving of manpower resources is achieved (today about 40 percent of all workers are engaged precisely in manual labor which is completely within the capability of robots). In case of the use of robots, which eliminate the participation of man directly in the production process, the changeover to two- and three-shift work, as well as work without days off is facilitated, which increases significantly the degree of use of other production equipment. The elimination of man with his emotions, fatigue, and possible inattentiveness is conducive to the more precise observance of all the technological requirements and standards, as a result of which defective output is reduced and the quality of items is improved appreciably.

With the absence of man at the machine tool, in the section, and at the line the work situation is simplified, the need for the assurance of a certain comfort at the workplace, lighting, the cleanness of the air, and a permissible noise level disappears, the question of the hazard of production and medical preventive measures and help is eliminated, and, consequently, the expenditures connected with all this also become unnecessary.

In robotized production the smoothness of the production process is observed at any time of the day, week, month, and year, which also proves to be a most important factor of the organization of production and, thus, of the significant increase of its efficiency.

The use of robots decreases sharply the cost of operations under extreme conditions. Remote-controlled robots make it possible to do without the direct participation of people in case of the performance of many operations under water and in mines and to decrease the cost and make safe the mining of minerals and other processes in the mining industry.

It is also difficult to overestimate the social significance of the extensive use of robotics in all the sectors of the national economy.

First of all, this is the freeing of man from monotonous and tiring manual labor. The number of people at a robotized automatic line is reduced significantly, although personnel for the adjustment and inspection of its operation still remain. However, perhaps, the most important social aspect of the automation of production consists in the fact that man ceases to be an appendage of the machine and becomes its real commander. This is changing radically the nature and is increasing the standards of the labor of both the worker and the engineer.

There is much routine work not only at machine tools and presses, but also in the checking of items, in the preparation of drawings, and in the making of calculations. The robot is also capable of taking all this upon itself. It does not have to machine a part and assemble units and items by using drawings and technical charts--digital problems, which have been developed in the computer-aided design system, replace them.

The freeing of man from all types of monotonous and unappealing labor will enable him to concentrate on more interesting intellectual activity, our society's need for which is continuously increasing. This will contribute to he spiritual development of man and to the increase of his skills and overall culture. Robotics in combination with computer technology is transforming the nature of the activity of people on the job, by eliminating the differences between mental and physical labor.

The social importance of robotics in the solution of the problem of the shortage of manpower resources is also great. Without the mass use of if only the simplest robotic systems (along with traditional means of the mechanization and automation of production processes) in all the sectors of the national economy this problem will not be completely solved.

The replacement of manual labor with mechanized labor with the participation of robots and manipulators eliminates many occupational diseases, since man is freed from tiring and difficult operations close to hot furnaces and under the conditions of an increased content of dust and harmful vapors and from efforts, which cause the overexertion of some human organs or others in the presence of vibrations, noises, and so on.

The present scientific and technical revolution is inseparably connected with the development of electronics, computer technology, and information systems. This has already led to previously unheard of diverse forms of the automation of various types of human activity and has literally transformed all aspects of scientific research and production operations. Now, with the development of robotics and microelectronics, a new revolutionary stage of the increase of human potentials is approaching. By using the achievements of mechanics and cybernetics, the robot unites three functions of man in the process of its labor activity: the perception of the external environment by means of sense organs, the weighing and making of decisions, and active influencing of the external environment. This fundamentally new machine is increasing immeasurably the possibilities of the complete automation of production and the development of flexible and nearly unmanned production systems.

With the development of robotics and the transition from the first generation of robots to the second and third generations information processing processes are playing a larger and larger role both in the development of robotized systems and in their use in production. The majority of problems of the adaptation and artificial intelligence of robots are being solved precisely by the information program-algorithm means of computer technology.

Various sensors (tactile, location, optical, power, and so forth), as well as microprocessors for the processing of the information received from the sensors for the purpose of analyzing the external conditions and recognizing objects in the work environment are envisaged for this within the robot itself. As a result the corresponding control signals, which are fed to the drives of the manipulators for the performance of one technological operation or another by means of other equipment, are automatically formed.

When changing over from individual robots to robotized technological systems, it is necessary to examine the information problems which are connected with

the organization of the joint operation of the group of robots and the basic production equipment which is controlled automatically in a unified complex by means of a computer. Here the flow of information is divided into a number of components:

--the transmission of signals from the robots and equipment after primary processing in their own microcomputers to the central control computer;

--the receipt and processing of the information in this computer;

--the transmission of the processed signals to the control systems of the robots and other equipment;

--the automatic monitoring of the operation of the entire complex;

--the issuing to the production controller of the necessary information on the state of all the subsystems of the complex and on the progress of the technological processes.

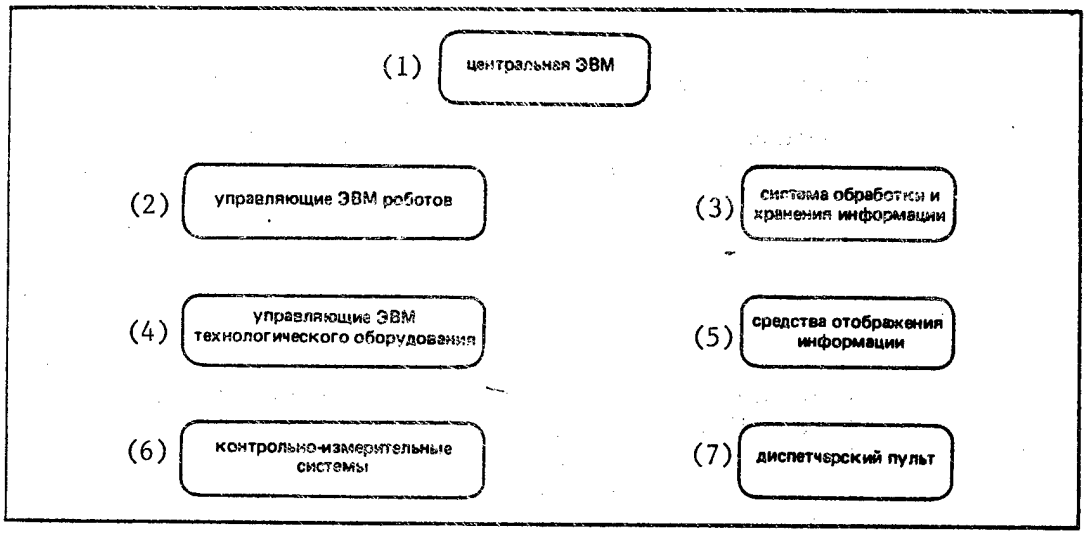
Such a complex is organized on the scale of either the production line or the entire shop.

The system of the attendance of a thermonuclear power unit like a tokamak, which is being developed with the participation of the Moscow Higher Technical School imeni N.E. Bauman (MVTU), can serve as an example of a robotic complex with combined control which unites automatic operation with the use of remote-controlled manipulators. In this system the complex of robots and the sources of information are located in the active zone, while the remote-control posts are located in a safe room.

The organization and technical realization of information processing in robotic systems have several peculiarities. In particular, the entire complicated information complex of robotized production, which was described above, should have the most economical and simple algorithms and software. This is necessary, first, so that control would be carried out in the real time of the technological process (but would not slow it down) and, second, for the simplicity and reliability of the system. Hence there also follow the specific demands on the performance of the control computer and the built-in microprocessors of the robots and other equipment. Moreover, the signals from each of the sensors of the robot and the monitoring instruments are also specific.

All the information is usually processed by microprocessors, microcomputers, and minicomputers. New integrating digital structures, which make it possible to integrate simultaneously several electric signals, were recently developed at the Taganrog Radio Engineering Institute of the RSFSR Ministry of Higher and Secondary Specialized Education. An experiment conducted at the Moscow Higher Technical School imeni N.E. Bauman showed that their use jointly with microcomputers in information processing systems can increase the speed of the output of control signals by tens and even hundreds of fold. This is affording new prospects of real-time control in complex robotic systems in case of a large amount of information.

Structure of the System of Control of the Robotic Technological Complex. Such a complex includes a number of objects of shop equipment (a line, a section), which are served by industrial robots and are interconnected by information and control aids, of which microcomputers and minicomputers constitute the main part. At the production control console the progress of the automated technological process is reproduced and an account of the results of the work is kept. The production controller through the central computer can adjust the progress of the process.



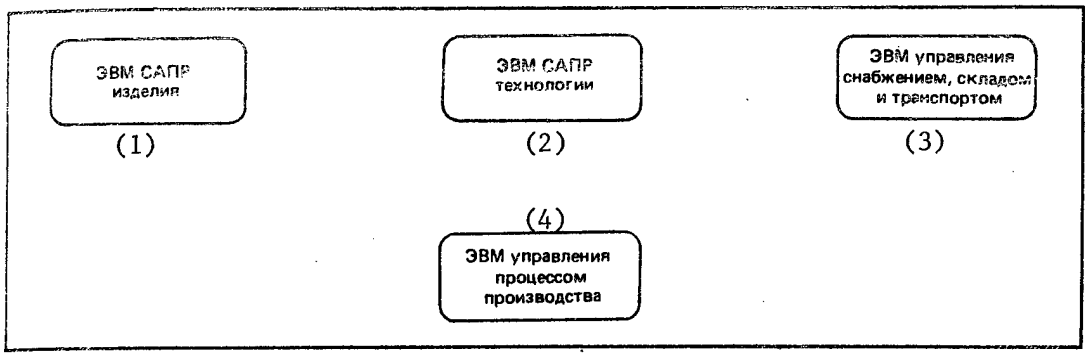
Key:

1. Central computer
2. Control computer of robots
3. Information processing and storage system
4. Control computers of production equipment
5. Information display equipment
6. Control and measuring systems
7. Production control console

In case of the use of sensors (especially in systems with television sight) redundant information is frequently received. In order to satisfy the above-formulated requirement--the need for the processing of information in real time and by the simplest means, in each specific case one has to select from the entire flow that minimum of data, which is necessary for the recognition of objects under specific conditions and is sufficient for the solution of the posed technological problem (in particular, only the outline of the necessary object is singled out from the complete television picture). On the other hand, at times it is necessary to use additional information. Thus, if it is possible, in principle, to differentiate parts by area, for reliability an additional attribute (for example, the number of angles in the outline of the part) is introduced. Then the robot will select with greater probability the necessary part from two or several which are in the work area. At times for

the increase of the reliability and precision of the control of a robot the same quantity is measured simultaneously by two sensors which are based on different physical principles. For example, in several robots the instantaneous position of the units of the manipulator is determined simultaneously by potentiometers and pulse transducers. The latter are used constantly for control by means of a computer, while the former serve for comparison and correction in case of an interruption of the count of pulses, as well as in the initial and set control positions.

The Connections Between Computers in Flexible Computer-Aided Production Systems. The complete automation of not only the production process, but also the designing of the item itself, which precedes it, and the technology of its production is characteristic of the flexible machine system. Computer-aided design systems (SAPR), which are created on the basis of computers, are used for this. Such complexes of computers and other equipment for information processing, which are connected with each other and with the basic production equipment, ensure the optimum organization of all the processes and the increase by many fold of production efficiency with the minimum number of service personnel.



Key:

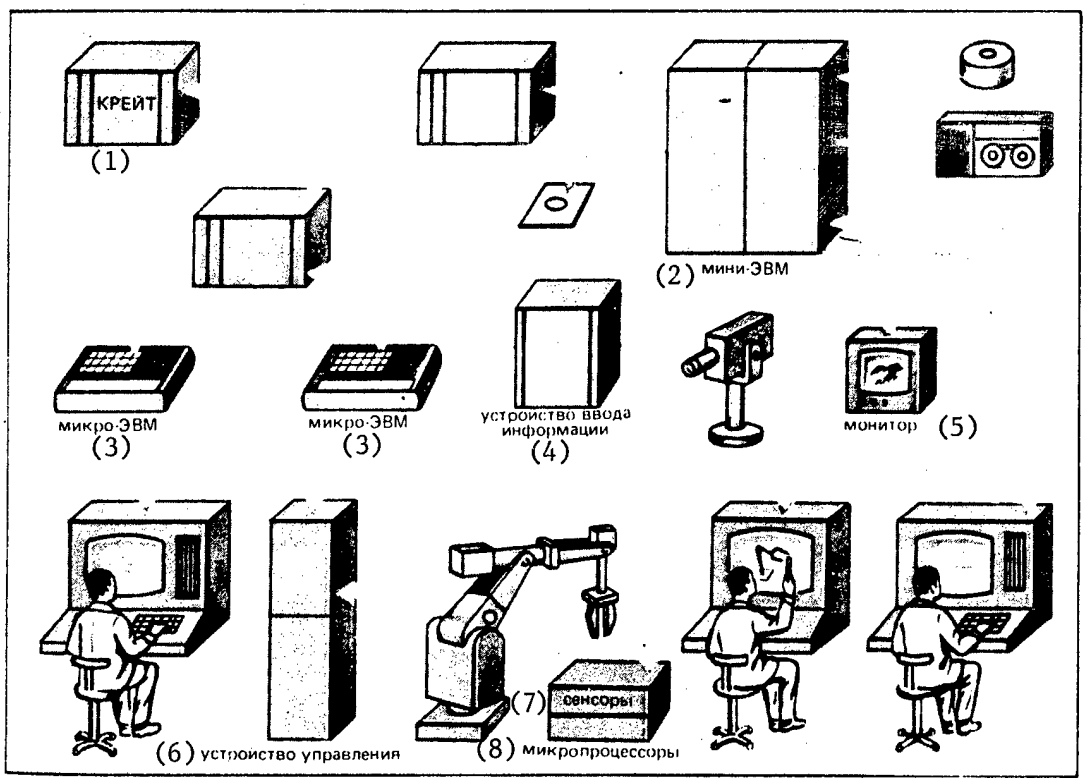
1. Computer of the computer-aided design system of the item
2. Computer of the computer-aided design system of the technology
3. Computer of the control of supply, the warehouse, and transportation
4. Computer of the control of the production process

It is possible to get an idea of the means of the sensitization of robots from examples of the developments of the Robotic Systems Chair of the Moscow Higher Technical School imeni N.E. Bauman.

In addition to a television system we also developed a type-transparency matrix system of technical sight, which is mounted directly in the wrist of the manipulator of the industrial robot. The system was made in two versions. In the former of them the matrix consists of 16X16 photodiodes and makes it

possible to differentiate 2 gradations of brightness (black and white), in the latter the matrix of 32X32 components automatically differentiates up to 16 gradations of brightness in the image of the object being observed. The type-transparency matrix system is less expensive, more compact, and more reliable than the television system, is less demanding on lighting and its fluctuations, and as a whole is more convenient under shop conditions.

Diagram of the Instrument Complex for the Development of the Control and Software of Robotized Systems. This complex was developed on the basis of microcomputers and minicomputers with an abundant set of peripheral devices, which enable specialists to perform work in an interactive (dialogue) mode, while not only monitoring its progress on the display screens, but also actively influencing it (by putting directly into the computer the necessary corrections at any stage of the process). The various electronic circuits of the complex are united into modules, which are installed in special frames--CAMAC crates.



Key:

1. Crate
2. Minicomputer
3. Microcomputer
4. Information input device
5. Monitor
6. Control device
7. Sensors
8. Microprocessors

Sensors of the power sensitization of robots, which contain elastic components with resistance strain gauges which have been cemented to them, have also been designed. The wrist of the electromechanical robot with such sensors changes its configuration subject to the form of the object, automatically adjusting its movement in conformity with the magnitude of the working force, which is important, for example, in assembly operations.

An ultrasonic location system of sensitization, at the center of which is a small source, while along the edges there are four receivers, was developed for a number of technological operations (in particular, the connection of hoses) and in general for the homing of the wrist of the robot on the object. By means of it angles in two planes and distances are measured with an error of not more than 5 percent.

All these attachments significantly broaden the possibilities of operating robots and robots which are being designed.

In all the flexible readjustable machine systems being developed today manual labor is eliminated not only in the performance of technological operations, but also in the designing of items and the development of the technologies of their production. Here the information on the design of parts and on their machining arrives at the shop no longer in the form of drawings and technological charts, but in the form of a digital program, which has been recorded on some carriers or others and is sent directly to the computer for the control of the warehouses of blanks, parts, and tools, transportation devices, production lines, means of monitoring and testing, and so on--up to the packaging and shipping of the finished items.

The multiple increase of production efficiency in case of the use of flexible completely automated systems is mainly a result of the optimum organization and interconnection of all the production equipment into a unified smoothly functioning organism by means of information-control computer hardware, as well as the use of advanced technologies.

When individual sections of production are uncoordinated, this impact to a significant extent disappears. Due to the lack of a uniform rhythm it is necessary to create extra (and at times considerable) interoperation stocks of parts and assemblies, which in general are unnecessary in case of the complete automation of all production as a whole. In this case many operations on the production of new attachments and accessories in case of a change of products also disappear, time and the number of people in the shops are used sparingly, the rate of the output and the quality of products increase.

Special instrument complexes are used for the development of the information part of the control systems of adaptive robots and their software. For example, at the Moscow Higher Technical School imeni N.E. Bauman such a complex was developed on the basis of an SM-4 control minicomputer and several Elektronika-60 microcomputers with the use of a CAMAC (Footnote 1) (The English CAMAC--Computer Application for Measurement And Control--is a general-purpose system of communication between various computers and the external devices connected to them. The uniformity of the reading of a word in both directions symbolizes the possibility of the transmission of information from

the measuring equipment to the computer and back. See in greater detail, for example: L.A. Matalin-Slutskiy and I.F. Kolpakov, "Automated Systems of Scientific Research and CAMAC Equipment," PRIRODA, No 2, 1984, p 79) system for communication between them, as well as for the input of information from various sensors and its output to the control devices of the manipulators.

In this complex precisely the information-control part of the robotic system is subject to study and processing, while its sensors and manipulators are connected to it, as they say, in physical form, with all their merits and drawbacks. The complex is equipped with additional memory units, disks, displays, and printers. An interactive mode of operation, that is, the direct access of the user to the complex from his terminal, as well as the output of the results on graphic displays and printers for checking, is envisaged.

It is difficult to exaggerate the role of information science in the development of industrial robotics in general and flexible machine systems in particular. The need for the use of various computers, microprocessors, and much other hardware that is connected with them, which form various information-control systems, is also obvious. Of course, many unsolved problems also remain in the mechanics of robots and in their drive units (especially NC electric drives), but the questions of information processing and its effective algorithms and software are appearing to a greater and greater degree among the central problems. Our hopes for the radical reform and significant intensification of production and for the appreciable acceleration of scientific and technical programs are mainly connected precisely with them, as well as with new principles of the organization of technological processes.

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